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LONDON GAS SUPPLY

GREATER London suffered severely from reduced gas pressures during last week's cold spell, and a good deal of unmerited criticism was levelled at the Gas Light and Coke Company and neighbouring undertakings, the gist of which was that they were largely, if not solely, responsible for the failure of the gas supply, which was admittedly due to shortage of labour. A statement signed by Mr. Charles Dukes and Colonel H. C. Smith, Chairman and Vice-Chairman of the National Joint Industrial Council for the Gas Industry, was issued on Saturday, in which they said:

"We are bound to point out that there is no justification for this criticism. It was as long ago as May, 1945, that the National Joint Industrial Council, in conjunction with the Ministry of Labour and National Service and the Ministry of Fuel and Power, surveyed the labour requirements of the London Gas Companies. in conjunction with those of other undertakings throughout the country, with the object of ensuring that their labour force should be sufficient to meet the 1945/46 winter load. The survey made it abundantly clear that the existing labour force was totally inadequate, and this fact has been pointed out on very many occasions, both to the Ministry of Labour and National Service and to the Ministry of Fuel and Power. As Chairman and Vice-Chairman of the National Joint Industrial Council for the Gas Industry we have repeatedly urged upon each of the Ministries the paramount necessity of providing the additional labour (including Military labour, Italian co-operators and prisoners of war) that would be necessary to prevent a breakdown of gas supply. We fully appreciate the difficulties of the Ministries concerned, but we feel that in fairness to the London Gas Companies the above facts should be made known."

Pressures were reduced early last week, when the cold spell entailed a sudden rise in consumption, and on Thursday, the coldest day for twelve months, there was a further cut. As a result of meetings on that day between representatives of the companies and the Ministry of Fuel and Power, a substantially increased number of troops were placed at the disposal of the companies, and by Saturday—helped enormously by the end of the cold snap and the return of milder weather—pressures were very much better. In most places they were up to normal for the Sunday dinner cooking load, and dropped only a little below normal afterwards. Throughout the period of shortage it was emphasized that the difficulties were due, not to immediate lack of coal, but entirely to lack of labour, a circumstance intensified by the fact that enemy action during the war years had left all the affected companies short of holder accommodation, and consequently prevented so complete a building up of reserve supplies of gas during mild weather for use in cold spells, as was possible in pre-war days. It is extremely improbable that we shall get through the winter without any more low temperatures, but it is hoped that the arrangements which have been made as the result of last week's experience will be adequate to meet the needs of the remaining winter months.

WASTE HEAT RECOVERY

THE series of Papers which are being published by the Institute of Fuel on the subject of waste heat recovery are likely to prove of considerable value to industry as a record of the present state of the art. While the principles of waste heat recovery are in general well known to most gas engineers, they are not necessarily as well known as they should be. A very great deal of useful information which may be termed the basis of the subject was contained in the Fuel Efficiency Bulletin No. 42, "Waste Heat Recovery," recently issued by the Ministry of Fuel and Power. To industry generally this bulletin is likely to be of more value than the Institute of Fuel discussions. The Institute of Fuel discussions, on the other hand, appeal to a different audience, mainly comprising the specialist. With the conclusion of the series therefore industry will be in possession both of a Ministry of Fuel Bulletin which will be of immense value to the main bulk of industrial engineers who are not expert on the subject, and of a most valuable series of specialist Papers designed primarily to improve the art. The recovery of waste heat at gas-works is to be the subject of a special Paper, upon which we shall no doubt comment in due course.

The Papers already published have contained some notable contributions to the subject, and we would single out as particularly important in their additions to our new knowledge the Paper on the design of regenerators by T. C. Finlayson and A. Taylor entitled: "An Experimental Determination of the Factors Covering the Design of Regenerators with Special Reference to Coke Ovens," and the Paper on "Tubular Metal Recuperators" by G. N. Critchley. The Paper by T. C. Finlayson and A. Taylor (upon which we hope to comment in a later issue) comprises an experimental investigation conducted by the Woodall-Duckham Companies upon a section of a full size regenerator which we venture to suggest will for a long time to come provide the data from which mathematicians will draw their information for their investigations on the mathematical theory of heat transfer under these conditions. G. N. Critchley's Paper summarizes the Ministry of Supply experience and data concerned with the recovery of heat from industrial furnaces by recuperators. Unless we are misinformed, the Ministry of Supply designed a metallic recuperator for general furnace work, and this Paper summarizes the considerations which led to that design. There are, however, other metallic recuperators which are also highly efficient, and with the improvement in metals that has taken place during the war there can be little doubt that metallic recuperators will be used to an increasing extent.

THE METALLIC RECUPERATOR

SINCE recuperators are used in the Gas Industry to the virtual exclusion of regenerators we may justifiably consider briefly the recuperator Paper first. Brick recuperators have certain limitations which are quite well known, but because they are suitable for high temperatures they have been used for the recovery of waste heat from gas-works retort settings. They are still retained as a means of preheating the secondary air for horizontal retort settings, but they have been superseded in most recent vertical retort settings in favour of direct recovery of the waste heat in waste heat boilers. Whether this practice will continue indefinitely is not certain; Mr. Ernest West, speaking in a discussion at an Institute of Fuel meeting last year, said: "The brick built recuperator has been abandoned for the two main reasons that, in the first place it is too bulky, and in the second place it is liable to become less effective on account of internal leakage. In one or two recent instances the metallic recuperator has been successfully used, and it is intended to investigate this further when conditions permit."

Nor must it be forgotten that the obvious advantages of the

metallic recuperator are likely to be greatest in its application to gas-heated industrial furnaces. The efficiency with which gas can be used in the furnace is of great importance in view of the higher initial price of gas per therm as supplied at consumer's meter, compared with solid fuels. In the development of the metallic recuperator a very important weapon has been placed in the armoury of the industrial gas section of the Gas Industry. Mr. Critchley has given figures illustrating the use of tubular metallic recuperators in conjunction with furnaces performing a wide variety of heating services at furnace temperatures ranging from 450–1,200°C. The continued advance in metallurgy is rendering possible ever higher temperatures, and Mr. Critchley has indicated how the arrangement of the recuperators can be used to enable the waste heat to be recovered from gases at temperatures which would otherwise be too high for the metal. For handling gases up to 500°C. mild steel can be used. Comparatively cheap alloy cast irons, which have a reasonable resistance to oxidation, and are capable of maintaining their shape without undue growth, can normally be used up to temperatures of 600°C. Calorized mild steel has been successfully employed in constructing recuperators for use at metal temperatures up to 800°C., but the calorized coating is very susceptible to attack by the corrosive liquids deposited if the gases should be cooled below their dew-point. One manufacturer of metallic recuperators used heat-resisting cast iron for waste gas temperatures up to 850°C. and air temperatures up to 450°C.; for waste gas temperatures up to 1,050°C. and air temperatures up to 700°C., 30–35% chrome iron is used. For still higher temperatures there are materials which may be technically suitable, but which for the time being appear to be too costly and to be rather brittle at low temperatures. In blast furnace stoves 25% chromium alloy has proved satisfactory at 1,100°C., and 25–20 cr.-ni. steel at 1,100–1,150°C. There are other alloys which are yet expensive which can be used for still higher temperatures, but as yet these must be regarded as rather in the experimental stage. There are indications that an alloy containing 30% chromium and 5–6% aluminium will resist oxidation at 1,250–1,300°C. This information shows that already quite high temperatures can be dealt with in metal recuperators, and that there is the probability that further high temperature alloys can be used at still higher temperatures.

When the temperatures are too high for the use of metals that can be obtained at reasonable cost, a parallel-flow or a cross-flow recuperator can be used in place of a counter-flow design. For waste gases up to 500°C. the counter-flow recuperator is superior to the parallel-flow, but when temperatures over 500°C. are encountered under conditions that do not permit of the use of special metals, the primary consideration becomes the life of the metal, and thermal efficiency must be sacrificed to this. The degree of heat exchange is inevitably less in the parallel-flow design, and it is probable from theoretical considerations that with waste gas at 1,000°C. it is virtually impracticable to preheat the air to temperatures higher than about 500 to 600°C. Nevertheless, the possibility of using metals such as mild steel for temperatures considerably above their normal safe limit is not to be ignored. Everything depends on the rate of heat transfer through the metal, since the objective must be to prevent the metal from becoming overheated. A high rate of heat transfer from metal to air, with a lower rate from waste gas to metal, will enable this to be done; there are known methods of effective control of the rate of heat transmission. The design of metal recuperators is a matter for the expert, and Mr. Critchley's Paper should materially assist in making more generally known the possibilities of replacing brick recuperators by metal. The great advantage is the absence of leakage; given metal partitions it is possible to combine metal and brick, and an example is published of the use of brick baffles to extract heat from the flue gases and re-radiate it to the metal partitions.

Why not use waste heat boilers to recover the heat? That is a fair question, and it is a solution that has been adopted many times and in many industries, not least in the Gas Industry. In our view every possible means should be tried and adopted to reduce the fuel consumption in furnaces (including gas retort settings) before installing waste heat boilers. We would suggest, though we are open to correction, that the use of the waste heat boiler is a confession of failure. It is a confession that we cannot make the furnace more efficient by anything we can do economically, and that the only thing that remains is to accept the position and cut our losses by converting them into steam. We believe that we have support from such authorities as Dr. S. Pexton for this view ("Fuel Requirements of Carbonizing Plants," "GAS JOURNAL," 1943, **241**, 63), since he has shown that to secure maximum overall efficiency it is necessary to return to the heating process every therm of heat which can be so returned, and he looks forward to the progressive reduction in waste heat steam production from vertical gas retorts to 780 lb./ton of coal carbonized. This principle is certainly true of retort settings when coke breeze can be used for steam raising. We believe it to be true of all furnaces, so that the general use of recuperation or regeneration should be practised to the utmost practicable extent in industrial furnace technique generally. This principle will no doubt not be forgotten by the industrial gas centres of the Gas Industry. We have been rather disappointed to see so little contribution from these centres to the discussions initiated by the Institute of Fuel on waste heat recovery, for it is a matter of the greatest importance to the Gas Industry.

"JOURNAL" Calendar and Directory

The 1946 Edition of the "GAS JOURNAL" CALENDAR AND DIRECTORY has now been published, and within the next few days every Journal subscriber should have received his copy. In its general layout the new edition is of very much the same appearance as its predecessors, but this year, for the first time since 1940, when the ban was placed upon the publication of accounts and working results of public utility undertakings, the information contained in the Directory of Gas Undertakings represents the figures for the last completed financial year. The ban had, in fact, been partially relaxed while the 1945 edition was in process of being printed, so that the whole of the returns reviewed in the tables cover almost the last 12 months of the war period. Comparison of the results with those last published reveals some extremely interesting variations: for example, Birmingham Gas Department shows a total annual make of 19,805 million cu.ft. against the 1940 output of 16,812 million cu.ft.; Sheffield Gas Company sold 13,288 million cu.ft. against 10,128 million cu.ft., and Newcastle-on-Tyne sold 10,799 million cu.ft. compared with 7,246 million cu.ft. On the other hand, certain of the South Coast resorts which were badly affected by enemy action reveal an opposite trend. Eastbourne Gas Company had a total make of only 560 million cu.ft., against 744 million cu.ft. immediately before the war, and Folkestone Gas Company made 300 million cu.ft. compared with 500 million cu.ft. Statistics regarding the percentages of industrial load also indicate to some extent the expansion of gas utilization during the war years. Information regarding Holding Companies has been brought up to date, although on the whole there have been comparatively few changes in ownership during the past year.

Considerable revision has been necessary in the Handbook Section relating to emergency legislation. War time legislation, comprised in over 12,000 Statutory Rules and Orders, continues in a modified form, and a summary of the position to mid-October, 1945, as affecting the Gas Industry, is set out. Publication of technical literature, which was almost entirely in abeyance during the war, has been only partially resumed, and there are few additions to the "Gas Engineer's Bookshelf" compiled by T. A. Tomlinson.

Turning to what may be termed "the other side" of the Gas Industry, a considerably extended Buyer's Guide indicates the variety and extent of the service which manufacturers of plant, instruments, and appliances are able to offer to the manufacturing side of the Industry. A general increase in the optimism expressed in the display advertisements is another reflection of the improved circumstances in which the Industry faces the problems of 1946.

"Gas Salesman's Pocket Book."

A number of enquiries and orders are reaching us for the "Pocket Book," publication of which was forced into abeyance by the war. It is our great regret that restrictions still prohibit production. We hope for relaxation before the end of this year, and the earliest possible notice will be given to our readers.

Personal

Mr. C. H. BUNCLARK, B.Sc., has now been appointed a Director of the Franki Compressed Pile Co., Ltd.

Mr. HAROLD BUCKLEY, Technical (Engineering) Assistant at the Lanarkshire County Council Gas Department, has been appointed Assistant Engineer to the Pontypool Gas and Water Company and takes up his new duties this month.

Mr. WILLIAM H. EMERY, A.C.I.S., Accountant to the Farnham Gas and Electricity Company, has been appointed General Manager and Secretary in succession to the late Mr. A. E. LOGSDON, who was Managing Director and Secretary of that Company.

Mr. FRANK DAVIES, recently returned from war service as Flt.-Lieut. in the Royal Air Force, has been appointed London Manager of Arden Hill & Co., Ltd. (Radiation Ltd.). Mr. H. MACKEY has retired after 35 years' service with that Company as London Representative.

Mr. FRANK HARVEY, Deputy Engineer and Manager of the Bilston Gas Light and Coke Company, has been appointed Engineer to the Spalding Gas Department. Mr. Harvey took up his Bilston appointment in 1939. He was previously at Dudley and Loughborough.

Mr. HERBERT C. GRAY, who has been Scottish Representative for John Wright & Co., Ltd. (Radiation Ltd.), for 38 years, has retired, and has been succeeded in that position by Mr. JAMES B. PEATTIE. Mr. Peattie has recently been demobilized after war service as Squadron Leader.

Mr. GEOFFREY I. HOATSON, who has held a Lieutenancy in the Royal Navy during hostilities, has been released from service, and has been appointed Northern Area Sales Manager of Cannon Iron Foundries, Ltd., near Bilston, Staffs, replacing Mr. G. A. VERNON, who has been appointed General Sales Manager.

The Directors of the Eastbourne Gas Company announce that they have appointed Mr. C. J. B. SAWBRIDGE, A.C.A., as Secretary in succession to Mr. SYDNEY E. KNOWLES, F.C.I.S., who is relinquishing the position. Mr. Sawbridge has been with the Company since 1935, first as Chief Clerk and Accountant and later as Assistant Secretary; Mr. Knowles continues to be a Director, and remains General Manager of the Company.

Mr. F. H. ROLT, M.B.E., has been selected for the appointment of Superintendent of the Metrology Division of the National Physical Laboratory on the retirement of Mr. J. E. Sears, C.B.E. Mr. Rolt has been a member of the staff of the National Physical Laboratory since 1912, but during the war his services have been lent to the Ministry of Supply, where he has held the post of Director of Jigs, Tools and Gauges.

Mr. H. G. STAPLEY, who has for the past six years been Assistant Engineer to Mr. C. F. W. RENDLE, Chief Engineer and Manager of the Redditch Gas Company, has been appointed Assistant Engineer and General Manager of the Exeter Gaslight and Coke Company. Mr. Stapley, who had formerly been with the Glossop Gas Company and on the staff of the Woodall-Duckham Company as Operating Engineer, expects to take up his duties at Exeter early next month.

The Parkinson Stove Company, Ltd., announce that to enable the Managing Director, Mr. R. J. ROGERS, to devote his activities to directorate duties in the Company and in other Associated Companies of the Parkinson & Cowan group, he will shortly be relinquishing his managerial responsibilities and will hold the office of Deputy Chairman of the Parkinson Stove Company, Ltd. Mr. GEO. COLLEY, Director and General Manager, will be relinquishing his appointment to take up other industrial duties, but will continue to act as a Director of the Company. Mr. W. LAWSON HURDMAN, M.Sc., M.I.Mech.E., has been designated to succeed Mr. Colley as General Manager, and Mr. JOHN W. BROAD has been appointed Sales Manager.

After 46 years' service with the Wellingborough Gas Light, Ltd., Councillor A. S. Campbell is retiring, and to mark the occasion a dinner was held in his honour. Councillor R. D. Pendered, Chairman of Directors, presided, and said that Mr. Campbell joined the Company as a clerk in 1899, and in 1916, following the death of Mr. Kimble, became Secretary, and in 1933 Commercial Manager as well. Mr. Campbell was presented with a portable typewriter. He will remain as a Director of the Company, and Mr. T. P. PATEMAN will succeed him as Secretary. Mr. C. C. WOOD, Engineer, becomes Engineer and General Manager, and Mr. D. A. FOSTER has been appointed as his assistant.

The New Year Honours List published last week included the award of the K.B.E. to Mr. W. G. NOTT-BOWER, Joint Deputy Secretary of the Ministry of Fuel and Power, and the C.B.E. to Mr. M. R. BRIDGEMAN, Principal Assistant Secretary of the Ministry of Fuel and Power; Mr. G. R. D. HOGG, Assistant Secretary of the Department of Scientific and Industrial Research; Major T. KNOWLES, Coal Tar Controller, Ministry of Fuel and Power; Mr. A. J. PHILPOTT, Director of Research and Secretary of the British Scientific Instrument Research Association; Mr. J. DAVIDSON PRATT, Director and Secretary of the Association of British Chemical Manufacturers; and Mr. B. C. WASTELL, Chairman of De La Rue Gas Development, Ltd. Lieut.-Cmdr. ERIC V. QUICKENDEN, who received the O.B.E. for distinguished service in the war in Europe, is employed by the Nottingham Gas Department, and is in charge of the gas showrooms in Parliament Street.

Mr. BENJAMIN TAYLOR has retired after 48 years' continuous service in the tar trade. He joined the staff of Major & Co., Ltd., at Wolverhampton in 1897, and stayed with that Company (finally becoming Manager there) until it was amalgamated with the Midland Tar Distillers, Ltd., in 1923, with which Company he remained up to the date of his retirement. Not only was Mr. Taylor in charge of an important section of the sales department of the Midland Tar Distillers, Ltd., but he also maintained personal contact on behalf of that Company with a large number of Gas Undertakings, in which field he had many friends. Presentations were made by the Directors in recognition of his long and loyal service, and at a ceremony on Dec. 31 the staff gave him a pair of binoculars and a cut-glass vase as a token of appreciation of his work amongst them in the past, and of their good wishes for his future health and happiness.

Mr. W. S. AULT and Mr. J. SIMPSON have been appointed Directors of the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd. Mr. Ault has been a member of the Woodall-Duckham staff for 31 years. He was educated at Birmingham Municipal Technical School, and served as an articled pupil to Mr. S. O. Stephenson of the Tipton Gas Department. He was also for four years on the engineering staff of the Birmingham Gas Department. Mr. Simpson has been a member of the Woodall-Duckham staff for 20 years. He was educated at Allen Glen's School, Glasgow, and served a pupillage at Robert Dempster's of Elland. During the 1914–1918 war he was a Pilot Officer in the Royal Air Force. He held the appointment of Chief Assistant Engineer and Manager of Greenock Gas Department before joining the staff of the Woodall-Duckham Company in 1926.

Presentations were made at Rotherham on Dec. 18 to Mr. W. H. T. JOHNS, Engineer and General Manager, who is taking up a similar position at Warrington, and Mr. W. G. EMERTON, who is retiring after 50 years' service with the Corporation. Alderman E. Cruikshanks, J.P., Chairman of the Gas Committees, in presenting to Mr. Johns a brief case and silver inkwell, said the Gas Department had been fortunate for some years in securing the services of very able engineers. He expressed regret at losing the services of Mr. Johns and wished him success and happiness in his new sphere. Mr. Emerton was presented with an electric standard reading lamp, together with wishes for continued good health and many happy years of retirement. Alderman Cruikshanks then introduced the newly appointed Engineer and General Manager, Mr. E. B. FIELD, saying that he was convinced that Mr. Field would prove a worthy successor and appealed for continued support and loyalty.

Mr. H. T. SEYMOUR has been appointed Chief Accountant to Whittaker Ellis, Ltd., Civil Engineers and Public Works Contractors, of Victoria Street, S.W. 1. Educated at Emanuel School, Mr. Seymour joined the Gas Light and Coke Company in 1915, and on the reconstitution of the National Gas Council in 1919 took charge of the accounts, being later appointed Accountant to the Council. He has also been responsible for the accounts of the Associations formed under the auspices of the Council—the British Road Tar Association, Conjoint Conference of Public Utility Associations, British Gas Federation, and National Joint Industrial Council for the Gas Industry. In 1930 his book on the *Principles and Practice of the Assessment of Gas Undertakings for Imperial and Local Taxation* was published by Walter King, Ltd., at the "JOURNAL" Office, and to a Supplement issued two years later, Mr. H. E. Ibbs (then Chief Accountant to the Gas Light and Coke Company) wrote an "Introduction." A revised edition of this work was in active preparation at the outbreak of war. Mr. Seymour has for many years contributed the annual "Taxation Notes" section of the "GAS JOURNAL CALENDAR AND DIRECTORY," and the article entitled "A Review of Case and Statute Law as Affecting Water Supply Undertakings" in the *Water Engineers' Handbook*, as well as writing on income tax and rating matters for Accountancy and Technical Journals. Before Mr. Seymour left Gas Industry House, Colonel S. S. Ogilvie, D.S.O., Joint Manager of the National Gas Council, presented to him a silver cigarette case with the best wishes of his colleagues.

Obituary

Will Thorne, C.B.E.

Founder of the Gas Workers' Union, which later became by amalgamation and natural growth the National Union of General and Municipal Workers, the largest union of its kind in the world, Mr. WILL THORNE, C.B.E., for 39 years labour M.P. until his retirement from Parliament at last year's General Election, died at his home at Upton Manor on Jan. 2, aged 88. Born in humble circumstances, he tramped from the Midlands to London in 1881 and found work as a labourer at the Old Kent Road works of the South Metropolitan Gas Company. He became an advocate of trade unionism among the unskilled workers in the various gas-works of the Metroplis where he worked from time to time, and at an open-air meeting at Canning Town in 1889, with the assistance of Mr. Ben Tillett and others, he founded the union which was destined to become so great. He was chosen as Secretary by ballot, being paid a salary of 45s. a week. The Union affiliated to the Trade Union Congress in 1890, and Mr. Thorne was elected a member of its Parliamentary Committee in 1894. Two

years later he became Chairman of the Committee, and he attained the Presidency of the Congress in 1912.

Close connexion was established by the National Union of General and Municipal Workers with the international Trade Union movement, and Mr. Thorne went as delegate to many Continental congresses, and once as fraternal delegate of the T.U.C. to the American Federation of Labour. Later he visited Canada on a similar mission to the Dominion Trades and Labour Congress, and during the 1914–18 war he went on a mission of enquiry to Russia. On his return he was received by the King at Buckingham Palace, and he and his colleagues presented a confidential report to the Coalition Cabinet.

Mr. Thorne was for many years Deputy-Chairman of the National Joint Industrial Council for the Gas Industry, and the late Sir David Milne-Watson, in receiving a presentation on his retirement from the Council last year, paid warm tribute to his work in the interests of maintaining good relations between employers and employed in the Gas Industry. After holding the office of Secretary of his Union for 45 years, he retired in 1934. He was made a C.B.E. in 1930, and in the Dissolution Honours last June he was appointed a member of the Privy Council.

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Assistant Engineer to Lincoln Gas Department when he joined the R.A.F. in 1944, Sergt. JOHN F. WEST, who was reported missing from an operational flight over the Continent in July of this year, is now known to have been killed. The Air Ministry has informed Sergt. West's father, Mr. F. A. West, Engineer and Manager at Altrincham, that the aircraft in which he was engineer crashed near the village of St. Martin-sur-Oreuse, Yonne, France. All seven members of the crew were buried in the village cemetery.

The "JOURNAL" Calendar and Directory

The undernoted changes in the "JOURNAL" Directory were received too late for inclusion in the 1946 Edition, which should now be in the hands of our readers. It is proposed to continue our practice of publishing in the first issue of the "JOURNAL" each month a list of the various changes of which we are advised in order that readers may keep the particulars contained in the Directory up-to-date.

Page 2.—ABERTILLERY. H. Maycock, *E.M. & S.*, resigned.
" 12.—BRITISH GAS LIGHT COMPANY, LTD., HOLYWELL, FLINT AND RUTHIN. H. Maycock, *E. & M.*
" 24.—EAST SURREY. A. Tennant, *G.M.*, *vice* J. R. W. Alexander.
" 28.—GAS LIGHT AND COKE COMPANY. F. M. Birks, *M.D.*, and M. Milne-Watson, *M.D.*, N. Willsmer, *C.E.*
" 44.—MANCHESTER. J. H. Cadman, *C.M. & S.*, resigned.
" 50.—NEWCASTLE-UNDER-LYME.—E. N. Farnworth, *E. & G.M.*
" 74.—WATH ON DEARNE. E. N. Farnworth, *E. & M.*, resigned.
" 78.—WITNEY. L. W. J. Dillamore, *M.*, A. C. Machin, *S.*

Wales and Monmouth Juniors

Mr. R. J. AUCKLAND welcomed the members to Cardiff when the Wales and Monmouthshire Junior Gas Association met at the offices of the Cardiff Gas Light and Coke Company on December 20, Mr. H. Williams occupying the chair. Mr. Auckland referred to the Domestic Development Committee which had been set up by the British Gas Council, and said it would present opportunities for the younger members of the Industry which they would soon appreciate. They would find in due course that they would be called upon to take quite a prominent part in the work of the Committee, which would go into every side of the consumer service and cover the whole ambit of gas sales. It would be necessary, whether they were nationalized as an Industry or not. Gas sales would have to go on, and it was gas men who would have to see to them.

Letters of apology for inability to attend were read from Mr. E. Singleton (Chepstow), Mr. R. S. Snelling (Newport), Mr. J. H. Chapman (Swansea), Mr. H. Maycock (Abertillery), Mr. S. D. Coole (Barry), Mr. Woosnam (Milford Haven), and Mr. D. S. Rowlands (Caerphilly).

Mr. H. WILLIAMS, in calling upon Mr. K. M. Ernest to deliver his presidential address, recalled that in 1937 it had been his honour to be elected President of the Association and Mr. Ernest was the new secretary. It was with great pleasure and confidence in the future welfare of the Association that he now saw Mr. Ernest take the chair. He came to it with eight years of hard work in the best qualifying academy, the secretaryship, and he anticipated that they could look forward to an interesting and eventful year.

Mr. K. M. ERNEST then delivered his presidential address (see p. 65).

Congratulating Mr. Ernest upon an interesting Paper, Mr. WILLIAMS wondered whether poultry-keeprs might not be able to make use of the same process as pig-keepers for plucking their poultry. It was an idea which might be worth while looking into.

Mr. I. G. JENKINS, proposing a vote of thanks to Mr. Ernest, said his Paper had reflected the very wide and varied experience of industrial work which he had enjoyed under Mr. B. J. Bell in the Cardiff Centre. They also knew how helpful he and Mr. Bell had been to other Centres who had consulted them regarding their problems and difficulties. He was particularly interested, himself, in the process for shrinking steel bands, and he knew how grateful the firm in question had been for the help given them.

Mr. R. H. BONE (Cardiff) seconding, said it was good that they should be reminded of all the possibilities for expansion of the Industry which presented themselves during this period of turning over from war-time to peace work.

Mr. B. J. BELL, associating himself with the good wishes extended to the new President, referred to the Heyworth Report, and said that whatever it had in store for them as an Industry it would bring great opportunities with it for the young men, and it behoved them to watch them carefully and take the chance with both hands when it presented itself. No industry during the war years, he added, had been better served by its employees than the Gas Industry.

The PRESIDENT, briefly returning thanks, referred to the departure of Mr. D. J. Heycock, their secretary, on Dec. 31, following his appointment as Deputy Engineer and Manager to the Spenborough Gas Department. He extended his warmest congratulations on their behalf to Mr. Heycock, together with their thanks for his services during the short period in which he had held the secretaryship. They would now have to make a fresh appointment, and the Committee meeting prior to that meeting had agreed to leave the matter in abeyance until the next meeting to give members a chance of thinking the matter over.

It was agreed to forward to Mr. W. R. Branson, past President, the congratulations of the Association on his new appointment as Manager in charge of the Ruhr gas supplies.

Institution Gas Research Fellowship

The Senate of the University of Leeds has approved the award of the Institution Gas Research Fellowship, 1945–46, to Mr. G. W. Culshaw, B.Sc., A.R.I.C., previously a senior chemist to the Liverpool Gas Company.

Diary

Jan. 11.—London and Southern District Junior Gas Association: Gas Industry House, 7 p.m. Paper, "The Domestic Use of Coke," Dr. F. J. Eaton.
Jan. 12.—Scottish Junior Gas Association (Eastern District): Visit to New Grange Works of Alder & Mackay, Ltd.
Jan. 14.—Women's Gas Council: Executive Committee, Gas Industry House, 1.15 p.m.
Jan. 16.—British Gas Council: Domestic Development Committee, Gas Industry House, 1.30 p.m.
Jan. 16.—Joint Meeting of the Institute of Fuel (Yorkshire Section), Coke Oven Managers' Association (Midland Section), Manchester District Association of Gas Engineers (Yorkshire Commercial Section), Manchester Junior Gas Association, Yorkshire Junior Gas Association, and Midland Association of Gas Engineers and Managers, Royal Victoria Hotel, Sheffield: Paper, "Waste Heat Recovery in the Carbonizing Industries," Dr. J. G. King and Dr. F. J. Dent.
Jan. 17.—Fuel Luncheon Club: "Operation P.L.U.T.O.," A. C. Hartley, Chief Engineer, Anglo-Iranian Oil Co., Connaught Rooms, 12.40 for 1.10 p.m.
Jan. 17.—Solid Smokeless Fuels Federation: Executive Committee, Grosvenor House, 11.30 a.m.
Jan. 21.—London and Counties Coke Association: Finance Committee, 11 a.m.: Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m., Gas Industry House.
Jan. 26.—Manchester and District Junior Gas Association: Annual dinner, Engineers' Club, Manchester. Paper, "The Application of Laboratory Tests to Works Control," C. Whitehead (Preston).
Jan. 26.—Midland Junior Gas Association: Visit to Incandescent Heat Co., Ltd., Smethwick.
Jan. 29.—Southern Association of Gas Engineers and Managers (Eastern District): Paper, "Gas Charges, with Special Reference to Tariffs," A. Tennant (East Surrey Gas Company), Gas Industry House, 2.30 p.m.

A scheme has been drawn up for the amalgamation of nine trade unions catering for foundry workers into one body under the title of the Amalgamated Union of Foundry Workers of Great Britain and Ireland. A ballot of members on the scheme is to be held during the next three months. The unions concerned are the National Union of Foundry Workers; the Ironfounding Workers' Association; the National Union of Stove, Grate and General Metal Workers; the Amalgamated Moulders' Union; the North of England Brass, Aluminium, Bronze and Kindred Alloys Moulders' Trade and Friendly Society; the Iron, Steel and Metal Dressers' Trade Society; the United Metal Founders' Society; the Associated Society of Moulders and Foundry Workers; and the General Iron Fitters' Association.

Shaping Things to Come*

By JAMES M. A. MITCHELL

Newcastle-upon-Tyne and Gateshead Gas Company

A FEW months ago I asked a manager of one of the larger firms of domestic gas appliance makers to give me some idea of his production programme. This was not idle curiosity on my part, and it was more than merely friendly interest, for the activities of the appliance makers and of the gas sales departments of our Industry are very closely interlocked. He replied by asking, "Can you tell me the shape of things to come?" I could not tell him, and he could not have done very much about it if I had been able to make a convincing forecast, for I found that he had scarcely any moulders, and the greater part of his works was still cluttered up with war jobs.

However, the question suggested the title of this Paper. It is true that the title begs the question, but I am hoping that it will be worth while for us to sit back for an hour from the detail of our jobs to attempt a review of the desires and tendencies which are shaping things to come, the planning which it is hoped will give effect to those desires, and the part which the Gas Industry has played in their planning and the work it has to do to make these plans effective.

It may be that this is altogether too ambitious a programme for an Auxiliary Section meeting, but I think that freedom of discussion at a level below that of those charged with the responsibility of making major decisions of policy is a good thing, and may produce useful results. Responsibility is apt to cramp a man's style, be he Gas Manager or Cabinet Minister, so for the moment we may rejoice in the freedom that our relative irresponsibility gives us.

Planning, I suppose, begins with a studied attempt to find out what people really want, and goes on to balance the sectional wants, individual or group, and to satisfy them as economically as possible, while at the same time advancing the general good of the community and using to the full the resources of nature, the skill of our craftsmen, and the complex machinery of our industrial, social, and political organizations. It is very difficult to find out what people really want. It is too big a task, and beyond my competence and outside the usual scope of our discussion to attempt an analysis of all the desires and tendencies which are shaping the future, but some of the desires of the common man are manifest. He wants peace, steady employment under good conditions, a comfortable and well-equipped home for his wife and himself, adequate leisure and facilities for enjoying it, a good education for his children, and opportunities for culture and development for himself, and he believes that the national economy should be deliberately directed to these ends. Of these desires we here are most interested, from the professional point of view, in the desire for comfortable and well-equipped homes.

Functional Design

The aspect of house planning which particularly interests the Gas Industry is the functional design of the house as a home. Because of its intimate experience of household activities and problems the Industry views the house not merely as a structure into which certain fuel-burning appliances have to be fitted and to which an indeterminate quantity of fuel must be supplied, but as the focal point of individual family and social activities which require an appropriate and comfortable setting, and many of which require a discriminating and specialized use of fuel for their adequate performance.

The Industry has unique opportunities for studying these matters. It not only provides a continuous and measured supply of fuel of unvarying quality right up to each appliance, but it supplies and fixes or prescribes the appliances themselves. It advises as to their use, and maintains them at the highest standard of efficiency. Its representatives are consulted not only as to appliances required for particular duties, but as to their running and performance afterwards. When the Gas Industry wanted to know the amount of gas required for family cooking, it not only made laboratory tests of the quantity used for different cooking programmes for various sized families, but examined the accounts of thousands of families using gas for cooking only. It has studied in selected areas the amounts of gas used in various sized houses, with various selections of equipment, especially those with "all-gas" fuel equipment and various numbers of occupants. It has set itself to meet the needs of the weekly wage earner, and of those who have difficulty in finding the capital for new appliances. In short, it has really become, as its official classification states, a Public Utility Service, and as such is in close touch with the needs and desires of the public.

The Gas Industry, through its outdoor development and service representatives, in some districts one to every 3,000 gas consumers, and the work of the Home Advisory Section, contacting in the Newcastle and Gateshead Gas Company's area some 22,000 housewives per annum, is in a good position to make an interpretation, and that with much greater accuracy than by the summarizing loosely-worded questionnaires scattered through random selections of the population. The Industry is, however, continually hampered by having to adapt its appliances to unsuitable circumstances. The best appliance for the job should not be an afterthought, an addendum to a less satisfactory system, but should be part of the functional plan of the house, a plan which was seldom, if ever, adequately considered in pre-war architecture.

This involves an examination of those functions of a household in which artificial heating plays a part, not only as they have been usually conducted in the last few generations, but as they would be conducted if they could be set free from limitations imposed upon them by some of the fuel-using systems in common use.

Cognizance of Altered Conditions

In such an examination one of the first things we notice is the limitation and entanglement of function brought about, especially in the small dwelling, by some of the characteristics of coal when used raw as a household fuel. Coal has to be kept in a store so situated that the dust and turmoil attendant upon its delivery will not damage the better parts of the house. It must be filled into scuttles and carried manually into each room where heat is required. Along with it paper and sticks are brought from another store, and each fire must be laid, lighted and tended for some time before the heating is required—a tedious and dirty job. At the close of the heating period, or at any rate before the fire is required again, the fireplace must be cleared and cleaned, and the ashes taken away or deposited in yet another store—a still more tedious and dirtier job. A coal fire is a costly method of obtaining heat for a short period, and in many households neither the money nor the labour can be spared. Thus householders are forced, when confined to raw coal as fuel, to solve the problem by dispensing with bedroom heating altogether except in emergency, and by confining communal usage to one room. If the cooking also is to be done by coal, and economy is essential, the cooking must either be brought into the living room, or the living room merged in the kitchen. In this connexion, and also in regard to atmospheric pollution mentioned below, the tremendous contribution made by the almost universal use in urban areas of gas cookers must not be overlooked. Its full benefit has not been realized, because house designers have not taken full cognizance of altered conditions.

In such cases running hot water must either be dispensed with altogether, or the water heater tacked on to one of the fires required primarily for other purposes. If in a household which runs a separate kitchen and sitting room the kitchen range is chosen, it must be kept going when no cooking is required. If the sitting-room grate is chosen the fire must be kept going on warm days and when the room is empty. The tendency again is to telescope and confuse the functions of the rooms. Nor is this compensated for by the degree of physical comfort obtained. The house depending upon one or two solid-fuel fires is not well heated.

The Gas Industry offers a convenient and economical heat service for every function in the home requiring it, and there is a growing volume of opinion that new houses should be so planned that every housewife should be enabled to take advantage of its benefits, and have real freedom of choice as to its installation, unhampered by structural difficulties or capital commitments for apparatus which she has no intention of using, such as a Yorkshire range or a bedroom coal grate.

It is not an easy matter to rank the various heat requirements of a house in order of priority, but for convenience cooking and water heating may be taken first, for by isolating them it is possible to select the space-heating appliances best suited to the particular rooms unhampered by dual purpose considerations.

The gas cooker requires, and deserves, consideration in the planning of the kitchen. The original recommendations of the Gas Industry were as follows: A site with a floor area of at least 2 ft. 6 in. wide by 2 ft. deep suitable for the reception of a domestic gas cooker should be provided in the kitchen. The site should be convenient for use, well lighted, free from draughts, and in such a position that adequate ventilation may be provided for the removal of vapour and cooking smells. The adjacent walls and floors should be so finished by tiling or other suitable means that they may be easily cleansed from the spray of cooking fats and accidental spillage. It is recommended that special provision should be made in kitchens for adequate ventilation to ensure the necessary air changes for the removal of smells due to cooking, washing, &c., and so to prevent them from permeating the house. It was hoped that the final Ministry regulations would go beyond this and prescribe a suitable cooker site which will give the occupier of the house free choice of any type of cooker, including the more convenient pattern with oven at table level, for which a width of at least 4 ft. is required, and also require that a natural means of ventilation, such as an adequate 9 in. by 9 in. flue, should be provided.

Since these proposals were put forward the situation has been changed by the remarkable popularity attained by the "built-in kitchen unit" idea. Several lines of thought have contributed to

* A Paper read before the North of England Gas Managers' Association (Auxiliary Section) on Dec. 7, 1945.

this. An old-standing demand for more cupboard space in bedrooms and kitchens has by now led to the provision of built-in fitted wards robes and kitchen cabinets. The standardization of certain sizes for kitchen fittings has facilitated their assembly.

Lack of space in the temporary accommodation houses and the desire to prefabricate them led to the design of a very compact or, may one say, a very cramped unit, which, because of its enamelled finish, its unified design and attractive colour scheme, made an immediate appeal to women when shown at exhibitions. It should be borne in mind that these particular sets are only required to last for ten years. Another factor of significance to us is the growing idea that the house should be provided with complete equipment for heating, water heating, cooking, refrigeration, clothes washing, drying, and airing, by the builders. The built-in kitchen unit appeals to the public as implementing this idea, but under the present conditions of house building it transfers the choice of type of fuel to be used from the occupier to the architect and builder to an increasing degree. This requires some re-orientation of our sales and propaganda methods, particularly as in the case of local authority housing there is a tendency for decisions to be made at higher and more remote levels.

It is unfortunate that the built-in kitchen unit has captured the public imagination when it is only at the exhibition stage. It should be regarded as experimental, and its behaviour in hard and careless daily use carefully watched. It is now generally accepted that running hot water should be available in every house, whether or not a fire is being used at the time for heating the living room or kitchen or whether a coal range is being used for cooking. This can be done in several ways, and details will be found in the Code of Practice for Gas Water Heating prepared by a Panel of the Codes of Practice Committee under the aegis of the Ministry of Works. There is a good case for the "all-gas" systems, but even where it is decided that an independent coke boiler or a solid-fuel back boiler should be installed, an alternative and supplementary gas water heater is essential for its economical and convenient working. Otherwise the necessity for keeping a certain fire going in order to provide hot water dominates a good deal of the functioning of the household.

The House Laundry

Whether the house laundry should be combined with the kitchen or be in a separate compartment is a matter perhaps not so much of opinion as of building costs. A gas washing machine, a combination of wash boiler, agitator, and rubber-rollered wringer, has proved the popular solution. It is expected that an improved type with gas heating of the boiler and electric drive to the agitator and wringer will be in production soon. These machines must be stored in such a position that they can be easily drawn into a clear floor space for convenient operation, and gas and electric points must be provided near by. A point must also be provided in a position convenient for the ironing board. Gas clothes driers and airers have been in use for many years, but their more general use has been hindered by the difficulty of finding space for them, and since they had usually to be made individually to fit the available recess the price has been unduly high. It would be much cheaper and more satisfactory to provide for them in the structure of the house.

In this moist and changeable climate comparatively cool, gently moving air is a necessity for health, and a measure of radiant heat is a necessity for comfort, both physical and psychological. It has been authoritatively recommended that every bedroom should have a ventilating flue, and if this is done, a gas fire in every bedroom is the ideal solution. The position of the flue should be considered in relation to the probable position of the bed, and in many cases a corner position will be most suitable.

Other rooms require individual treatment. The kitchen, usually small, while in occupation often gets a certain amount of heat from the cooking stove. A small gas heater, of the flueless radiator-*cum*-convector type, will make it comfortable while in use quite economically, and provision should be made for it. For the room which is likely to be occupied continually for long periods a solid-fuel fire with gas ignition has enjoyed a considerable popularity in the past and may be preferred, but it should not be assumed that the often expressed preference for a coal fire in this room is deep seated in the virtues of such a fire. Actually it has more faults than virtues, but long tradition has led to its being accepted as inevitable, and few people have seriously examined the possibility of bettering it. On the other hand, an idea has been handed down from the early days of inefficient gas fires and relatively expensive gas that gas fires are only suitable for intermittent use, to be turned on, like the light when the room is entered, and turned off again if it is vacated for a short period. It can be shown, and in this district has been proved by experience in hundreds of cases, that at the low commodity price of gas under domestic tariff rates, a gas fire in the living room is no dearer than a coal fire. For more occasional use in the alternative room it is cheaper. A gas fire in each enables full and free use to be made of both rooms—another example of the functioning of the household being set free from the limitations imposed by clumsy methods of dealing with fuel. Gas fires also provide the instant warmth required in emergencies, such as the return of the family on a cold wet day to a house which has been shut up sufficiently long for it to have cooled down.

New types of gas fires, having what has come to be known as a "convection component," are being developed, and these will not only reduce the running costs but will give a quicker rise in air temperature, and a better balance between radiant and convected heat. If the capital running costs of a complete gas-fired hot water central heating system to maintain a general background temperature of about 55°F. are too great, for general background heating a flueless gas heater in the hall will "take the chill off" the whole house.

The Gas Industry feels that both the installation and the design of gas appliances have, in the past, been hampered by the fact that in the majority of cases they have had to be installed either as addenda to existing solid-fuel appliances (as in the case of gas fires added to coal grates), or they have had to be fixed in positions which were not primarily or adequately designed for their reception. If certain general provisions are made, whatever form of fuel is finally selected, the appropriate type of appliance could be installed without causing unnecessary alteration or leading to incongruity. If, for example, a few critical dimensions of fireplace surrounds were standardized, one type of appliance could be easily changed for another without upsetting design details. Endeavours are being made to bring this about. Similar work is in progress with regard to gas water heaters and gas cookers, and advantage will be taken of the new materials and processes which have been developed during the war.

It may be objected that I have set forth not what the public want, but what the Gas Industry think they ought to have. This is a pitfall to be watched for. I hope I have avoided the pitfall when I have tried to analyse the functioning of a house as a home, and by so doing arrive at the implications of the expressed desire for certain amenities.

I have put forward claims to the Gas Industry's special interest in and special knowledge of some important aspects of house planning, and I have tried to show that these aspects are so important that they almost dominate the lay-out of the house. This is not yet generally recognized by house planners, but nevertheless the Industry has been taken into council to a degree that would not have been predicted before the war.

Official Planning

Official planning may be studied in the *Housing Manual*, 1944, prepared jointly by the Ministry of Health and the Ministry of Works, the Dudley Committee Report (Ministry of Health) on the "Design of Dwellings," and No. 1 of the Post-War Building Studies, "House Construction," by an inter-departmental Committee of the Ministry of Health, the Department of Health for Scotland, and the Ministry of Works (Burt Committee).

The Post-War Building Studies were made by a number of committees set up at the request of the Ministry of Works, and covering the different aspects of buildings of all sorts. That on gas installations was convened by the Institution of Gas Engineers. The Committee was directed to give first consideration to houses and schools, and this has been the general order of priority in this work. The Gas Installations Report has had a wide circulation, and it not only brings to the notice of housing authorities, architects, and builders what the gas installation can provide, but the provision which has to be made for the gas installation.

The Report is not "official" in the sense that the Government necessarily accepts the views expressed, but its contents are officially described as "authoritative," and it prepares the ground for the next advance. In August, 1942, a Standards Committee was appointed by the Ministry of Works and Buildings to collect, review, and correlate recommended standards put forward by the Building Study Committees, and to draft material to be used in the promulgation of official British Standards and Codes of Practice. The Institution of Gas Engineers is represented on this Committee, and among its earlier recommendations for British Standard specifications for windows, sinks, and other housing components is one for concrete gas-flue blocks. This is now in course of preparation.

In September, 1942, a Codes of Practice Committee was appointed to direct the preparation of Codes of Practice for civil engineering, public works, building, and constructional work. Again the Institution of Gas Engineers is represented, and again priority has to be given to Codes for single family dwellings and schools. These Codes are designed to cover the whole building structure, carcase, finishings, and installations, and they are guided by a Functional Code dealing with the over-riding functional requirements of a building which are independent of the type of equipment installed, and they are co-ordinated with each other with the help of liaison officers of the Codes of Practice Committee.

Drafting Panels of the Institution of Gas Engineers' Codes of Practice Committee have now got codes for service pipes, meters and installation pipes, lighting, hot water, space heating, cooking and refrigeration, and flues, as far as the printed "Draft Circulated for Comment" stage. Probably many of you on the supply side have seen these drafts and some of you may have contributed comments. I can say from experience that comments received are carefully considered by the Drafting Panels. These Codes are not mandatory, although they may be made so in specific cases by being incorporated in the terms of a contract, but they set up an attainable standard of good practice, and they make a considerable contribution to the integration of building operations.

The Gas Industry has too long skirmished on the outskirts of house planning and building. The work I have outlined brings it into line and into step with the other forces engaged in the provision of houses, from the Ministerial planning to the craftsmen's handiwork.

Pressure Regulation in the Distribution of Gas

By STANLEY M. THOMSON, A.Inst.Mech.E.,
Gas Light and Coke Company

(*Concluded from p.* 21)

In other words, the function of the auxiliary governor E is simply to maintain under the diaphragm a pressure P_U equal to an amount which will exactly counterbalance the dead weight of the loaded moving parts, and hence to maintain the governor valves in such a position that they pass an amount of gas necessary to maintain the required outlet pressure P_O.

This type of governor is thus eminently suitable for automatic loading, since it merely involves the automatic adjustment of the small governor E.

The precise operation of the Peebles system for doing this is as follows:

The main diaphragm D is permanently loaded to throw about 5/1 0in. W.G. above the maximum outlet pressure required. High-pressure gas from the inlet of the main governor is controlled by a small high-pressure governor G which reduces the pressure to about 3 in. or 4 in. W.G. above the maximum outlet pressure of the main governor, and thence through the needle valve Q to the control pipe H, which is connected to the underside of the main diaphragm. This intermediate pressure then passes through the clock-controlled auxiliary governor E, the outlet of which is connected to the outlet of the main governor. A mercury seal F is provided, and so connected as to by-pass the auxiliary governor E in order to avoid the risk of excessive pressures on the underside of the diaphragm D of the main governor should the governor G let-by. The needle valve Q restricts the rate of flow of gas through the secondary governors.

Assuming that a very small quantity of gas is passing, the main governor will be shut and the gas required will be passing through the high-pressure governor G and auxiliary governor E. The intermediate pressure between G and E will be acting on the diaphragm D and keeping the main governor shut. As the consumption increases and the outlet pressure tends to fall, the auxiliary governor E will open until more gas is passing it than is passing through the needle valve Q; as a result the intermediate pressure under the diaphragm D will fall until the pressure under the diaphragm equals P_U, when the main governor will open and maintain the predetermined outlet pressure for which the auxiliary governor E has been set. When the consumption decreases, any slight increase of outlet pressure will tend to close E, consequently the intermediate pressure between G and E will rise, and the increase of pressure will gradually close the main governor.

Predetermined variations in outlet pressure are effected by a clock control apparatus through the medium of a cam actuating a dipping rod (*a*), on the end of which is suspended a plunger which dips into a small cup of mercury (*b*) suspended from a lever resting on the valve spindle of the auxiliary governor E (fig. 6).

The auxiliary governor E is permanently loaded to throw the minimum outlet pressure required, and any increase in excess of this is obtained from the clock control mechanism. The plunger should just touch the surface of the mercury in the cup when the auxiliary governor is throwing the minimum pressure.

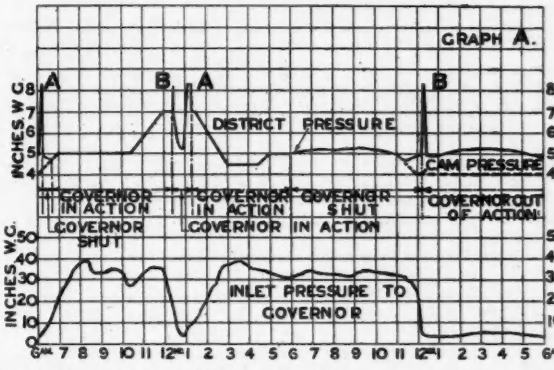
The action of the plunger dipping into the small cup of mercury (determined by the shape of the cams) displaces a certain quantity of mercury, the weight of which, by Archimedes' Principle, provides the loading required on the auxiliary governor E to throw the desired outlet pressure. The use of mercury as a medium for loading, the auxiliary governor E provides a flexible connexion between plunger and lever, which allows the valves of the governor E to rise or fall in accordance with varying consumptions and maintains the predetermined outlet pressure desired.

Two cams are provided, one for weekdays and the other for Sundays, and these cams are shaped in accordance with the pressure conditions desired at certain times of the day. A special ratchet cam causes the apparatus to change from the weekday cam to the Sunday cam by pushing one rod from a platform and allowing the other rod to move inwards and make contact with the platform, the complete change-over being effected at 1 a.m. when the Sunday and weekday minimum pressures are the same.

The above system of operation effects the desired regulation of the pressure excellently, *but it suffers from the serious disadvantage that the inlet pressure must always be kept above the maximum outlet pressure for which the main governor is loaded, otherwise there is insufficient power to lift the governor valves and keep the governor in action.*

It is quite usual in gas distribution systems that at certain times of the day or night the inlet pressure may fall below the maximum outlet pressure for which the main governor is loaded, and then even though the predetermined outlet pressure at the time may only be, say, 4 in. or 5 in. W.G. pressure, the main governor valves will open fully and the governor cease to function. During these periods the inlet pressure is admitted through the governor uncontrolled to the district, which will be flooded with the maximum outlet pressure for which the main governor is loaded, and it is not until the inlet pressure has risen above this maximum outlet pressure that the governor will be brought back into action.

Graph A clearly shows the condition which prevails when the inlet pressure falls below the maximum outlet pressure for which the main governor is loaded, also when the inlet pressure is restored.


GRAPH A.
INCHES W.G.
DISTRICT PRESSURE
CAM PRESSURE
GOVERNOR IN ACTION
GOVERNOR SHUT
GOVERNOR IN ACTION
GOVERNOR SHUT
GOVERNOR IN ACTION
GOVERNOR OUT OF ACTION
INCHES W.G.
INLET PRESSURE TO GOVERNOR
6PM 7 8 9 10 11 12MN 1 2 3 4 5 6 7 8 9 10 11 12NN 1 2 3 4 5 6AM

Graph showing Effect of Low Outlet Pressure A. *Increase in District Pressure before Governor is brought into action when inlet pressure is restored.* B. *Increase in District Pressure when the Governor falls out of action owing to inadequate inlet pressure.*

Double Diaphragm Gas-Pressure-Loaded Governor Automatically Operated by Clock Control Mechanism

This governor is designed to avoid the disadvantage of the system already described, while at the same time retaining the advantage of pressure loading, which lends itself to automatic clock control.

In the gas-pressure-loaded constant pressure governor (first system) it was necessary that the loading pressure should always be less than the outlet pressure required. In the double diaphragm governor, the normal functioning of which conforms to standard gas loading practice, the loading pressure is made to act on a smaller area than the main controlling area which is actuated by the outlet pressure. It therefore has to be greater than the outlet pressure that will be required, and the loading gas can leak away into the main against the outlet pressure.

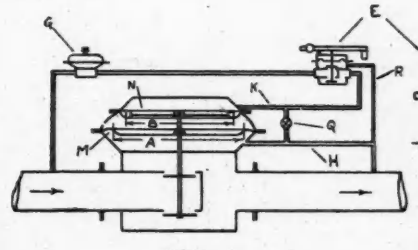


FIG 7

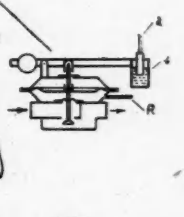


FIG 8

Referring to fig. 7, the main diaphragm M is subject on its underside to the outlet pressure, and is connected rigidly to a smaller diaphragm N, which is subject on its upperside to the loading pressure. The magnitude of this loading pressure is controlled by an auxiliary governor E, which is itself controlled by the same outlet pressure that controls the main governor.

The function of the auxiliary governor E is to maintain a pressure P_L equal to an amount which will be sufficient to load the main diaphragm M, and thus maintain the main governor valves in such a position that they pass a quantity of gas necessary to maintain the required outlet pressure P_O, which the auxiliary governor E has been set to give.

The space between the two diaphragms is vented to atmosphere.

Let A = effective area of main diaphragm,
B = „ „ small „
P_W = equivalent pressure thrown by weight of moving parts,
W = weight of moving parts.

$$P_W A = W,$$
$$P_W = \frac{W}{A}.$$

P_L = loading pressure on small diaphragm,
P_O = outlet pressure, acting on main diaphragm.

Then upward thrust = $P_O A$,
downward „ = $P_L B + W$,
= $P_L B = P_W A$.

Since the governor is in equilibrium—

$$P_O A = P_L B + P_W A.$$

Divide through by A,

$$P_O = \frac{P_L B}{A} + P_W.$$

In practice the ratio B/A is made equal to 2/3, and the value of Pw is conveniently set to 1 in. w.g.

$$P_O = \tfrac{2}{3}P_L + 1,$$
$$\text{Whence } \tfrac{2}{3}P_L = P_O - 1,$$
$$P_L = 1.5\,(P_O - 1) \quad . \quad . \quad . \quad . \quad . \quad (v)$$

The precise operational sequence of the Double Diaphragm Gas-Pressure-Loaded Governor is described as follows: In the main governor two diaphragms of different sizes are employed; the small diaphragm N is superimposed above the larger or main diaphragm M and connected thereto by a vertical valve spindle so that the movement of theformer is communicated to the latter and *vice versa*.

The weight of the combined moving parts, actuating on the main diaphragm M, throws a pressure of 1 in. w.g. at the outlet of the main governor (when the small diaphragm N is vented to atmosphere), thereby ensuring that the valve, will always tend to open when the inlet and outlet pressure approach equality.

In order to reduce the pressure due to the weight of moving parts to as low as 1 in. w.g. without the use of a counterbalance weight, it has been necessary to pay particular attention in the design to the weight of the valves and spindle, using light metals wherever possible.

The additional loading required to give the predetermined main outlet pressure P_O is obtained from the inlet pressure acting through the auxiliary governor E to load the smaller diaphragm N.

The space between the two diaphragms M and N is provided with a vent to atmosphere, which is controllable, as this is found to assist in preventing oscillation.

High-pressure gas from the inlet of the main governor is controlled by a small high-pressure governor G, which reduces the pressure to about 3 in. above maximum outlet pressure required, passes through the clock controlled auxiliary governor E, and thence to the pipe K which is connected to the top of the small diaphragm N. This intermediate pressure between E and K then passes through the needle valve Q, the outlet of which is connected to the outlet of the main governor through control pipe H.

The needle valve Q regulates the rate of flow of gas through the auxiliary governor E.

The main governor is controlled by the pressure from its immediate outlet, acting upon the underside of the larger diaphragm M through the control pipe H, which is connected to the main about 12 ft. beyond the outlet of the main governor; simultaneously the outlet pressure also acts upon the auxiliary governor E through the impulse pipe R, which adjusts the loading pressure on the smaller diaphragm N, thereby achieving immediate and dual control.

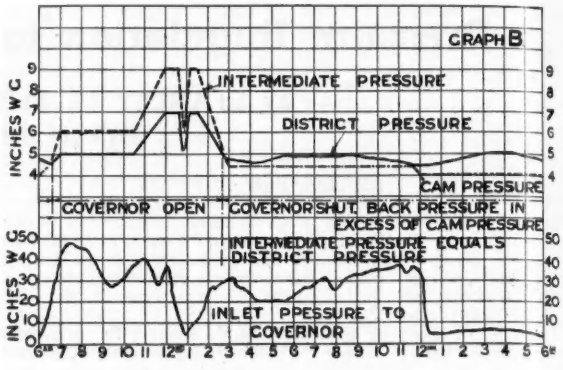
The auxiliary governor E is *not* controlled by the pressure from its immediate outlet, which, when the main governor is open, will always be greater than the controlling or main governor outlet pressure.

Assuming that the main governor is shut, the auxiliary governor E will also be shut, and the pressure on top of the small diaphragm N will be the same as that on the underside of the larger diaphragm M, which is the main governor outlet pressure. As the consumption increases the auxiliary governor E will open and the intermediate pressure on top of the smaller diaphragm N will, in consequence, increase, opening the main governor until the desired outlet pressure, for which the auxiliary governor E has been set, is re-established. Conversely when the consumption decreases, any slight increase of outlet pressure (imperceptible on the usual type of recording apparatus) will tend to close the auxiliary governor E; consequently the intermediate pressure on top of the smaller diaphragm N will decrease, and allow the main governor to rise until the outlet pressure required is re-established.

Predetermined variation in outlet pressure is effected by the clock control apparatus previously described.

The new design of governor provides a very accurate and delicate regulation, as will be seen from the results given by this governor in the Graph B, reproduced from an actual pressure recording chart, showing the pressures maintained at the inlet and outlet respectively.

It will be noted in the Graph B that during the peak load the consumption has been such that the inlet pressure has fallen below that for which the governor is loaded, and when the inlet pressure increases the exact predetermined outlet pressure is restored immediately.



Graph reproduced from actual Pressure Chart (Sunday).

From formula (v) two useful tables of figures can be derived showing actual pressure conditions prevailing at various outlet pressures P_O of the main governor:

TABLE I.

P_O Outlet pressure of main governor.	P_L Loading pressure on diaphragm N.	$\frac{2}{3}P_L$ Equivalent pressure on diaphragm M.	P_W Weight of combined moving parts.
3 in. w.g.	3 in. w.g.	2 in. w.g.	1 in. w.g.
4 „	4½ „	3 „	1 „
5 „	6 „	4 „	1 „
6 „	7½ „	5 „	1 „
7 „	9 „	6 „	1 „
8 „	10½ „	7 „	1 „
9 „	12 „	8 „	1 „

TABLE II.—Showing Outlet Pressure Obtained when the Inlet Pressure Falls to the same as the Predetermined Outlet Pressure.

P_1 Inlet pressure.	P_O Predetermined outlet pressure of main governor.	Outlet pressure obtained.
3 in. w.g.	3 in. w.g.	3.00 in w.g.
4 „	4 „	3.66 „
5 „	5 „	4.33 „
6 „	6 „	5.00 „
7 „	7 „	5.66 „
8 „	8 „	6.33 „
9 „	9 „	7.00 „

The main feature of this governor is that it does not fall out of action entirely even when the inlet pressure falls to the same as the predetermined outlet pressure, provided the inlet pressure is greater than 3 in. w.g. The governor remains in action, and will throw a reduced outlet pressure in accordance with "outlet pressure obtained" in above Table II. If the inlet pressure falls below 3 in. w.g. $P_L B + P_W A$ becomes greater than $P_O A$ and hence the governor remains full open.

If it is desired to shut down the high-pressure system altogether, and to maintain the supply at periods of low consumption by feeding into the low pressure mains from manually operated governors at the Works, the inlet pressure will fall until the values of P_L given in column 2 of Table I are attained. If a further fall in pressure occurs P_O will be greater than $(\frac{2}{3}P_L + 1)$, and the upward thrust ($P_O A$) on the larger diaphragm M will be greater than the downward thrust ($P_L B + P_W A$) on the smaller diaphragm N.

The valve will therefore be closed and will remain so until either—

(*a*) The works governors are unable to maintain the outlet pressure required, or—

(*b*) The inlet pressure is restored and the consumption becomes normal again.

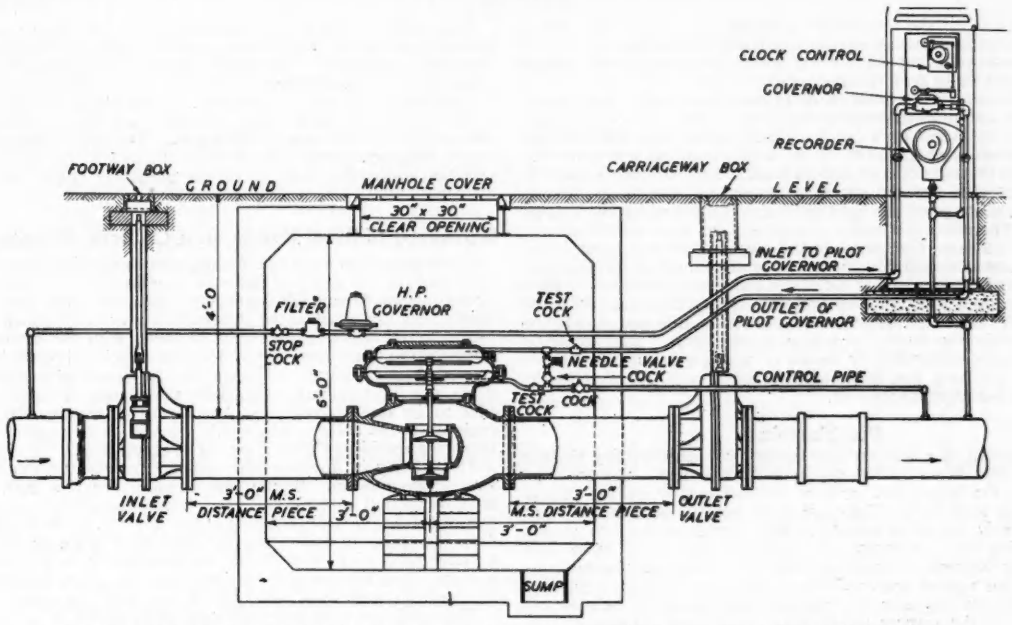
In practice, however, it will be arranged that condition (*b*) above occurs before the time that condition (*a*) is expected to occur.

It will thus be observed that the restoration of the inlet pressure after a period during which it has been inadequate, whether the pressure at the inlet of the governor occurred by desire or as a result of high consumption, does not result in the flooding of the district with high pressure.

This latest invention is illustrated in fig. 9, in which is shown a typical installation of a Double Diaphragm Gas-Pressure-Loaded Governor in sectional elevation. When developing this governor, advantage was taken to redesign completely the whole construction, and to incorporate certain features that would greatly improve the working efficiency, which it may be interesting to record:

1. The valve casing or body of the main governor has been so constructed as to provide a streamline effect to reduce the resistance to flow, and the loading diaphragm is superimposed directly above the main diaphragm, making a very squat and compact design, which is most essential when the installation is underground.

2. Large hand holes are provided in valve body to facilitate easy



Typical Installation for 12-*in.* "*D.D.*" *Governor* (*Pat. Spec. No.* 525226) *Pressure Loaded with Clock Control.*

access to the valves. This has been considered necessary when gum or other deposit is prevalent, necessitating frequent clearing.

3. The valves and valve spindle have been constructed in an aluminium alloy of a high tensile strength, reducing considerably the weight of the moving parts.

4. Leather-seated valves, shutting on knife-edge seats.

5. A ball-and-socket joint has been inserted between the main diaphragm and valve spindle to eliminate any friction which may occur by the canting of the diaphragm.

6. The auxiliary governor E, fig. 8, is a type which has a single leather-covered valve with a compensating diaphragm, a main controlling diaphragm, an impulse pipe and a floating spindle connexion between diaphragm and lever (the space between the two diaphragms being completely isolated from its immediate outlet).

7. A high-pressure service governor G has been introduced to reduce very high inlet pressures and prevent excessive pressures at the inlet of the sensitive auxiliary governor, of which the compensating diaphragm is very thin sheepskin, and becomes porous at 30 in. w.g.

Wales and Monmouthshire Junior Gas Association

Presidential Address*

of

K. M. ERNEST, M.Inst.F.

I CANNOT do better than deal with certain applications of town gas for industrial purposes which may be of interest to you, even though in some cases the annual gas consumption from some may not amount to more than a few thousand cu.ft. I purposely avoid dealing with the part gas has played in helping to win the war. For those of you who are interested, I would refer you to a paper, "Gas—in Industry at War," recently presented to the Institution of Gas Engineers by Mr. H. R. Hems, Chairman of the Industrial Gas Centres Committee. For convenience I propose dealing with some applications of town gas under separate headings.

Banana Ripening

Up to the outbreak of the last war bananas were imported into this country mainly from the West Indies and Central American countries. They are known to the trade as "varieties," named for the most part from the point of origin. Practically all the commercial importations belong to the one botanical variety—Gros Michel. The fruit was brought in refrigerated ships, the marine transportation varying from 14 to 17 days according to the port of entry. The bananas were then conveyed in ventilated cars to interior points, where they were ripened in special rooms heated by means of luminous flame gas burners.

Properly ripened fruit should have a good, attractive colour, and fresh appearance. It should have a firm pulp texture and good strength of peel in order to handle well during the distribution to the retailers. Improperly ripened fruit is recognizable by skilled men experienced in handling bananas. Ripening troubles are mainly due to (*a*) use of incorrect temperatures, (*b*) use of improper humidities. Fruit which has had too much heat during ripening may be recognized by its soft texture and weak skin. When it is subjected to a too low temperature while in a green condition the fruit will fail to develop a good bright colour, and develops instead a dull smoky yellow or brown, depending upon the degree of chilling.

Fruit which has been ripened with insufficient humidity suffers a considerable loss in weight and tends to ripen unevenly. This is readily recognizable by its stale, wilted appearance, and by indentations and discolorations of the peel, which will vary in severity with the extent of drying out. It appears that the cause of this is transpiration, which is regulated by tiny microscopic openings in the peel known as "stomates." These openings tend to close in a dry atmosphere, and it is thought that in so doing they retard respiration and ripening changes. On the other hand, when an extremely high humidity is maintained after the fruit has coloured, it tends to cause tender fruit.

Uneven ripening may be minimized by: (1) avoiding ventilation of ripening rooms while the fruit is green, as the carbon dioxide and small amounts of esters which are liberated during the process of ripening help to improve ripening and the colour of the fruit, and (2) using ripening stimulants such as ethylene gas, though this is as a rule unnecessary because of the slight trace of ethylene which apparently escapes unburnt from the gas burners. Experiments have proved that if ethylene gas is used, the quantity should not exceed 1 cu.ft. per 1,000 cu.ft. of room space. It will be appreciated, therefore, that the controlling factors in banana ripening are generally temperature, humidity, and ventilation.

Experience has shown that certain temperatures in conjunction with proper moisture and atmospheric conditions are necessary for best results. Within certain limits temperatures may be varied to increase or decrease the rate of ripening. Ripening temperatures are usually from 62–68°F., though little, if any, harm appears to result to hard green fruit from temperatures 5–10°F. higher than 68°F., for a period of half a day or so, providing a high humidity is maintained. Temperatures above 60°F., are not recommended for turning or ripe fruit; 56°F. is the normal temperature for holding ripe fruit.

To accomplish fast ripening of fruit, that is, in three to four days, temperatures and humidity differ from those that obtain when fruit is to be ripened in five to seven days, also with slow ripening—viz., nine to ten days. It has been found by experiment that the total carbohydrates (sugars and starch) of the banana pulp remain nearly constant during the ripening period, while the starch decreases from

* Delivered at Cardiff, Dec. 20, 1945.

20.65% to 1.21%; the total sugars increase from 0.86% to 17.91%. This is the result of the conversion of the starch into sugar.

It will be realized that the exacting conditions necessary for banana ripening can best be met by the use of town gas.

Ripening rooms are usually made of matchwood, and in a number of cases are about 20 ft. long by 10 ft. wide and 6 ft. to 7 ft. high. Four adjustable ventilators are provided, two at floor level for the inlet of the necessary quantity of air, and two in the ceiling for the outlet of the products of combustion, and the small amount of carbon dioxide liberated by the ripening bananas, though, as already mentioned, these gases are kept in contact with the fruit as long as possible. Therefore the outlet ventilators are kept nearly closed, so that the passage of air through the rooms is not too rapid. The burner equipment used for heating is of the simplest construction. In the case of a room having the above dimensions, two No. 7 Bray burners having a total gas consumption of approximately 25 cu.ft. per hour at 3 in. water gauge would liberate a sufficient quantity of heat to obtain the desired ripening temperatures. Each room is thermostatically controlled by means of a direct acting thermostat, a suitable type being that manufactured for Messrs. Elders & Fyffes by Perfecta Gas Appliances, Ltd.

Pig Singeing

The following is a brief outline of the process preceding the pig singeing operation as carried out by a Cardiff firm. The live pigs on entering the factory are rendered unconscious by placing electric tongs behind their ears. They are then hung, stuck, and allowed to bleed freely for some minutes. The carcasses are then passed into scalding vats to loosen the bristles and scurf, which are removed by scraping. It so happened that the factory under consideration had a good supply of steam, which was used for a number of processes such as ham cooking and fat extraction, otherwise I feel sure that the owners would have considered the use of gas, providing it could be applied with equal economy. I mention this point in order to give you an indication of the potential load in a factory of this type.

The vats are operated at temperatures of approximately 147°F., which is the most suitable temperature for softening the hair properly in a few minutes. At temperatures over 150°F. the hog carcasses may become cooked. As soon as the latter process is complete, the carcasses pass to a de-hairing machine and from there to the scraping bench, where any remaining hairs are removed. Scraping removes the coarse bristles and scurf, but a considerable amount of fine hair still remains, which can best be removed by singeing.

There are different methods by which singeing can be effected. The method adopted in Cardiff is by hand, using a semicircular air blast burner made by Messrs. Wm. Douglas & Sons, Ltd., London, and fitted with flexible connexions. Air is supplied at a pressure of 12 in. water gauge. One carcass is singed at a time. It takes from three to five minutes to singe, the time depending upon the size of the carcass, the gas consumption being approximately 6 cu.ft. per carcass. After singeing the carcasses are thoroughly cleaned and branded with a gas-heated branding iron designed and made by the Cardiff Centre. The use of paraffin blow-lamps was discarded due to the process being slow, and also there was a danger of paraffin being blown on to the carcasses during singeing.

Coffee Roasting

In the raw state coffee beans are of a horny texture and vary in shades of grey, green, yellow, blue, and sometimes brown. All green coffee must be roasted to induce certain physical and chemical changes fundamentally necessary to make available its aromatic, savoury and stimulating quality and to give the beverage its coffee colour. The process of roasting was originally carried out by placing large shallow pans over a charcoal fire. The next step was the introduction of the continuous output coal-fired perforated drum roaster. Subsequently the solid fuel was replaced by gas. Many improvements have been effected since, both in the design of the roasters and the methods of firing, gas being used almost exclusively.

Externally heated roasters are gradually being replaced by the more efficient internally heated ones, and even the latter are being superseded by the type in which the gas is burned externally to the drum and the hot products of combustion circulated. The hot products do not exceed a temperature of 900°F., it being claimed that this is the most suitable roasting temperature. A modern internally fired 56-lb. capacity roaster was recently installed by a Cardiff firm. This replaced a twin drum externally fired roaster of another make, having a capacity of 28 lb. of green coffee. The drum, which is perforated, is mounted on four rollers and driven by an electric motor through "V" ropes and a chain. The charging and discharging is effected through the same opening in the front casting by means of a reversible chute. After roasting, the coffee is discharged into a cooling tray and is continually stirred by means of power-driven paddles.

The roaster burner, which is of the slotted type, is mounted concentrally with the drum and extends the full length. Gas is supplied at low pressure, as also the air from a small belt-driven blower. A number of tests have been carried out on this roaster and also on an externally fired one. It was found that the saving in gas consumption when roasting with the former roaster amounted to about 38%. The average loss of the coffee due to roasting was approximately the same, for both roasters being approximately 17%.

The weights of the green coffee loaded into the roaster were varied, as also the gas rate, with a view to ascertaining the most economical working conditions. It is difficult to state specifically the gas rate which gave these conditions, as difficulty was experienced in matching the colours of each roast accurately. It was, however, apparent that a 60-lb. to 70-lb. charge with an hourly gas rate of approximately 550 cu.ft. was the most satisfactory. The gas consumption per pound of green coffee varied from 1.24 cu.ft. to 2.63 cu.ft., this variation being due entirely to the particular colour of the roast required.

Shrinking of Steel Bands on a Colliery Winding Drum

I have taken the liberty of dealing with this subject primarily as an indication of one more of the many applications of town gas in its already large sphere. Naturally I realize that the application is unique, but nevertheless the information may be of some use in the future to an engineer who may be faced with the same problem. The problem at the time was to heat two large steel bands in order to expand them sufficiently to mount on the bosses of a cable-winding drum at a local colliery. Originally the heating of these bands was effected by large blow-lamps, but owing to certain difficulties the engineer at the colliery where this job was to be carried out asked that the possibility of heating by gas be considered.

The colliery in question was installing new steam engines and a new winding drum. Briefly, the winding drum is built up from sections around an 18-in. diameter shaft driven from either side by two direct-coupled reciprocating steam engines. The sections which form the drum are bolted together and keyed to the main shaft. As a safety precaution steel bands are shrunk on to a boss on these sections, thus harnessing and tightening the drum as a whole. It was with this operation the Cardiff Centre was concerned.

The steel bands in this particular case were 6 ft. 5 in. external diameter, 4 ft. 9½ in. internal diameter and 2½ in. wide. These were suspended on the main shaft prior to it being set in the bearings. The drum sections were then bolted together, and the bands suspended one at a time in position ready to be slipped on to the bosses. The colliery engineer required an expansion of $\frac{5}{16}$ in. on the diameter. This meant that a temperature of approximately 470°C. was required. As the burner had to be of simple construction 1-in. diameter pipe was used; two concentric rings were made and cut into semicircles to enable them to be removed with ease. Single rows of holes $\frac{3}{16}$ in. diameter and 1½ in. centres were drilled in each burner, the total maximum gas consumption of which was 1,400 cu.ft. per hour. Owing to the general construction of the drum, heating could only be effected from one side. This, however, did not interfere with the excellent results obtained. The heating-up period lasted 50 minutes. Thus approximately 4.95 therms were used on each band.

Core Drying

Cores, as is well known, are composed of sand and a binder which hardens under the action of heat and binds the sand grains together into a hard mass. Cores required to be (*a*) strong, in order to withstand the high temperatures of molten metals and yet retain their original form; (*b*) porous, to permit free vent for the gases which are formed when the melted metal comes in contact with the surface of the core; and (*c*) smooth. This last quality is important, as it gives the castings a surface which is as nearly as possible in a finished condition.

There are a number of core binders in use, amongst which can be mentioned (*a*) linseed oil, which is the most prominent member of a group of organic liquid materials which have the property of being gradually transformed to a resinous material in contact with air. The transformation being due to the oxidation of unsaturated organic acids, the process being accelerated by heat, (*b*) molasses, (*c*) resin and pitch, (*d*) dextrin and rubber, and (*e*) fuel oil, as also a variety of proprietary binders, liquid and otherwise.

Molasses has an extensive use, but is open to the objection of a lack of uniformity in quality from deterioration through fermentation, and of the danger of burning, as of course with other binders, unless care is exercised in controlling the drying temperature. If underbaked the molasses is not hardened and does not properly cement the sand grains; if overbaked, it is burned or charred and its strength is lost.

The changes which occur during baking in the case of oil sand are: (1) the driving-off of moisture, (2) the decomposition of the bond, and (3) absorption of the oxygen by the unsaturated oils. The temperatures at which cores are dried vary considerably; these range from about 125°C., to 280°C., depending on the type of binder used. In the early type of stoves heating was effected by braziers, which were placed inside remote from the doors and the fires left to burn out. The circulation of the gases being irrelevant, the products of combustion and water evaporated were allowed to escape through cracks in the walls and gaps around the doors. In later developments the same general construction was followed, sometimes with definite outlets for the waste products, the changes made consisting of the fitting of outside fire boxes for coal or coke or the use of producer or other gas.

These stoves, although often yielding good results so far as the material being dried was concerned, were erratic. Some cores would be burned, while others were insufficiently dried; also the fuel con-

sumption was unusually excessive. In order to obtain good and consistent results in core drying it is essential to use a fuel which can be controlled accurately within the range of temperatures desired. I need hardly remind you that town gas is ideally suited, and in consequence is now being used extensively in all types of foundries. Its application in the majority of cases is simple, and can be adapted to old or new type ovens with little difficulty and excellent results.

The types of ovens in use are numerous, there being generally no standard sizes except with the small capacity shelved ovens made of sheet iron for light work. The larger ovens are usually constructed of brick or concrete, and fitted with iron shelves on which the cores to be baked are placed; or a track is laid in the floor extending into the moulding shop for cars and bogies to run on, and on which the material for drying is loaded.

Most modern ovens depend on the circulation of hot air for drying purposes. In some ovens a portion of the gases is withdrawn, and passed by means of a fan through a combustion chamber in which gas is combusted and then returned to the stove, a corresponding proportion of the gases being allowed to escape to atmosphere and so carry away the moisture. In others, simple low pressure atmospheric bar burners are used, these usually being fitted on either side of the oven. In all cases the application of thermostatic control is simple, the type used depending upon the particular method of heating which is decided upon.

As already mentioned, the sizes and types of ovens normally met with are numerous. Consequently no general scheme can be put forward for the conversion from, say, solid fuel to gas firing, the method of converting such ovens being dictated primarily by the local conditions.

The advantages for gas drying may not be always at first apparent in a tangible form, particularly with larger sized ovens, but as a result of prolonged tests it has definitely been established that the advantages claimed, namely, ease of control, cleanliness, and saving of space, to mention a few, are justified, and better results obtained in the final dried product with large or small cores or moulds when using town gas.

The Removal of Hydrogen Sulphide from Fuel Gases

The following discussion followed the Paper to the Institution of Gas Engineers by Messrs. G. U. Hopton, B.A., B.Sc., A.M.I.Chem.E., and R. H. Griffith, B.A., D.Phil. (see JOURNAL of Dec. 5, page 809):

Mr. C. COOPER (Messrs. W. C. Holmes & Co., Ltd.): In respect of a particular application of Messrs. Hopton and Griffiths' work, I can appreciate it, perhaps, better than most members of the Institution; I refer to their specific catch-box utilization. The Paper is, we must all agree, a very finished piece of work, and it is excellent not only in the work it describes, but in the presentation. The Authors have not said very much on what one might term the general application of their researches. It is a question of the cost of removing so many tons of sulphur from so much gas. We normally make a product in which the tonnage of sulphur represents about half the tonnage of the material to be handled. Is there some specific advantage in the long run in having a highly active material for this purpose?

The chemical principles which are so well set out in this Paper can obviously be applied to the commercial forms of oxide. It is no use buying purifying materials which contain large proportions of the oxides which are irreversible in this connexion. It depends on the overall activity and not on pieces that will work. It is, perhaps, not very safe to refer to the "problem" of gas purification, which is an expression some people dislike. They say that gas purification is not a problem; it is a job; you either know it or you do not know it. Many of us, however, are realizing that the problem which might not have been a very serious one a few years ago is gradually growing, and this should stimulate appreciation of the different chemical and physical principles relating to the part of the oxide that is active. Therefore, any assistance which can be obtained in lightening the burden of purification for the gas engineer will be of great value, and this Paper will be found to be a considerable help.

Dr. H. HOLLINGS (Gas Light and Coke Company): It occurs to me that I might perhaps help some members of the Institution to see this research in its right perspective if I refer to some of the motivating forces which lie behind it. The war which has just closed, like the 1914–18 war, has stimulated a number of chemical laboratory studies of the iron oxide-hydrogen sulphide reaction, because of the cessation of supplies of the continental purification materials on which the Industry has so largely relied. Thus the investigation of the two Authors has gone farther than many other purely chemical laboratory studies. It has not resulted primarily in the evaluation of a new and different laboratory assay or valuation test for alternative forms of iron oxide, but it has provided the gas engineer and the plant operator for the first time, as I see it, with a very beautiful explanation of the behaviour of purifiers in actual use, which hitherto has not been properly understood at all. Therefore, I would like to compliment them on the very beautiful result of their work.

Now I would turn for a moment to the chemical engineering side of the work, because therein there are also features which distinguish this investigation from very many others, and here I think the Authors will forgive me if, to a certain extent, I answer the question which has just been raised by Mr. Cooper. Looking at this problem from the chemical engineering side, there have been two objectives. In the first place we were, and we are, very interested in a catalytic process for the removal of organic sulphur from gas, which process results in the production of very low concentrations of hydrogen sulphide which must be removed from the gas prior to distribution. In such a circumstance the cost of the reagent used becomes less important than the cost and considerations of convenience of using the plant. Therefore, if there are advantages—and there appear to be—in using a selective iron oxide in the form presented by the Authors, then there would appear to be a set of circumstances in which such a material may be used in commercial practice. Consequently, I would refer to another set of circumstances in which it may prove commercially practicable to make use of this material. At the present time there is an increasing tendency to consider the design of gas-making plant for meeting peak load demands as quite a separate problem of design from the problem of making the base load gas. If that is the correct procedure, it would appear just as logical to consider the design of peak load purification plant, and it is in that direction we must look for further development of the use of this material. And I would, in mentioning this, just throw out a word of warning; I do not think members of the Institution should look too quickly for the development of the use of this material for the purification of the base load gas. There are two other lines of development which I think should come first. If we succeed in either or both of these directions, then, at a later stage, let us consider the problem of base load purification.

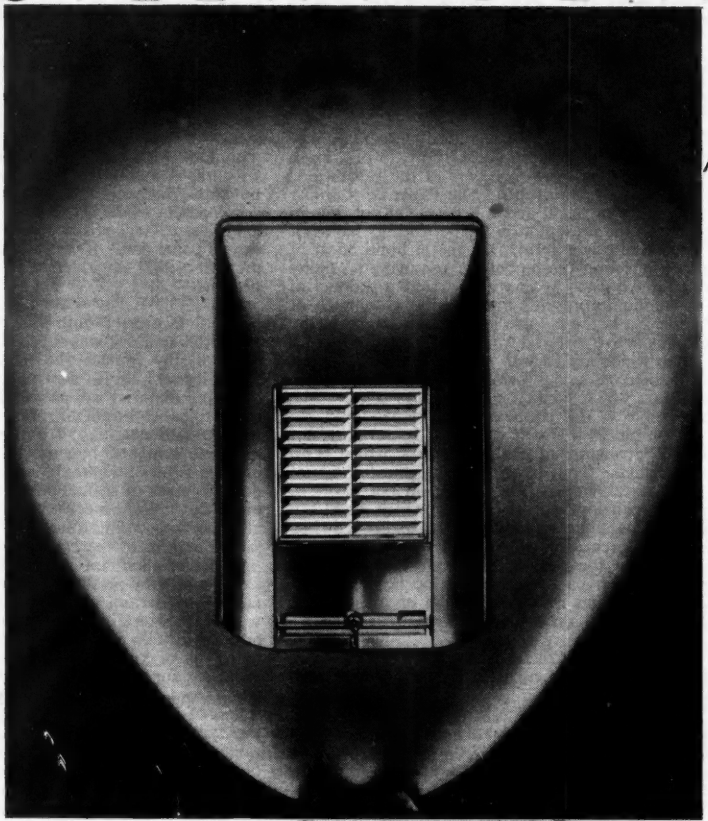
Mr. P. PARRISH (South Metropolitan Gas Company): In September, 1939, this country was faced with the problem of how best it could economically replace the large quantities of bog ore and "Lux" which it had hitherto purchased from the Continent. Any low-grade purifying material will absorb H_2S from crude coal gas if one is prepared to use sufficient air for revivification. My Company approached the problem essentially from the viewpoint of rendering immediately available synthetic bog ores having a range of activities, porosities, and pH values that would suit varying requirements. We found that dry processes of manufacture had less to recommend them than wet processes. We conceived the idea of using burnt oxide rendered alkaline with concentrated gas liquor or slaked lime as a carrier for ferrous oxides of the *alpha* type. We used a blunger for coating the particles of alkaline burnt oxide with ferrous oxide, derived from the treatment of by-product ferrous chloride with witherite, in the manufacture of barium chloride. The ferrous oxide-coated burnt oxide was pumped as a quasi-colloidal mixture over peat moss, or peat moss and sawdust in varying proportions, and suitably mixed. Purifying materials of various characteristics were produced and these were available for gas-works of varying sizes, who worked their outlet gases from the purifiers with various oxygen contents. To remove traces of H_2S, in some cases spent oxide was judiciously mixed with the synthetic bog ore. Peat moss has varying moisture contents, ranging from 25% in summer up to 35% in winter, and the quantity of ferrous oxide that one can incorporate depends on the moisture content of the peat moss.

When the accumulated stock of ferrous oxide from ferrous carbonate was exhausted we used, in the preparation of our synthetic oxides, (*a*) by-product ferrous oxide, and (*b*) filter press cake consisting of ferrous hydrate and calcium sulphate. Here we worked on somewhat parallel lines to those indicated in the Paper, with a view to concentrating *alpha* iron oxide. We extruded the ferrous hydrate-calcium sulphate press cake, and also ferrous oxide, using a piston and cylinder and perforated plate. The "strings" passing through the $\frac{1}{8}$-in. perforations were cut off with a guillotine at about three times their diameter. These "fingers" were dried and incorporated with the synthetic oxides, but we abandoned the use of the "fingers" with the advent of drier peat moss.

We have prepared about 90,000 tons of synthetic bog ores during the last six years. These have accumulated 50 to 55% of sulphur (wet basis) in two foulings, and we are glad to number the Gas Light and Coke Company among the regular users of our material.

It would be interesting to know the considerations which led to the research described. Much of the data on the various characteristics of the various forms of iron oxide have already been published. The chief interest in the Paper obviously lies in the possibilities of industrial development of the rather awkward, though very satisfactory, static type of plant. The pelleted process has attractions for the gas engineer in that less labour is involved, more space is economized, and the full capacity of the purifiers is utilized. But it would appear that a retrograde step is the use of calcium sulphate, although it is appreciated that this has advantages as a binder.

The [redacted] "SILENT BEAM" fire



NEW WORLD Gas Appliances

If only 30% of sulphur can be accumulated, this material offers no attraction to the sulphuric acid manufacturer, and solvent extraction becomes a necessity. It is known that this process at the present time is uneconomical. Accumulations of cyanogen-containing bodies, tarry matter, oil, and ammonium salts, must also be contemplated as constituent bodies of the spent pelleted material, and the presence of these will add to the difficulties of the application of a satisfactory and economic solvent process.

As regards Table III (Tests on Iron Oxides), is it not the nature of the pores, rather than the porosity percentage by volume, which is the primary consideration?

Underlying Chemistry and Physics

Dr. J. G. KING (Director, Gas Research Board): I find this somewhat academic treatment of the reactions between hydrogen sulphide and iron oxide of considerable interest. I have always held that a careful study of the underlying chemistry and physics can be of great assistance in the solution of many of our difficult technical problems. We all know the shortcomings of the oxide box, the greatest of which are probably the ground space required and the discontinuity of the process. If the former can be reduced, and the intervals of the latter increased by such studies as this, the fundamental approach is well justified.

The question of how many oxides of iron there are, and what is their exact nature, has always been a controversial one. The very different behaviour of oxides in their combination with hydrogen sulphide seems to indicate that modifications of contact material will be of importance in this connexion.

The Authors indicate that the rate of reaction depends chiefly upon ease of penetration, and therefore upon the porosity of the contact material. Is this entirely true? The absorption of hydrogen sulphide is a relatively simple chemical reaction, and must also be related to the area of surface exposed. Area of surface is again not directly related to porosity; for example, sintered oxide of low surface area but high porosity is found to be a slow-acting agent. I agree, of course, with the Authors when they say that a granulated reagent would give the best performance. In this case, however, we have a combination of high porosity with large surface area, and the result should be better than with a pelleted material. As a matter of interest, I have seen one process of granulation in operation where an oxide-water paste was extruded under pressure through a perforated plate directly into a drying tower. The dried threads were broken and granulated.

In evaluating porosity, in Table V the Authors deduce that porosity beyond 50% is the deciding factor in determining the effective value of any given oxide. I see some danger in this deduction, since the pressures used were very heavy, and surface flow might have created an impervious surface or skin. Might I suggest that it would be helpful in this Table to include the surface area values as determined by a method such as that of Brunauer, Emmett, and Teller, which involved the sorption of nitrogen at low temperatures and pressures.

Mr. K. FRANCOMBE (The Whessoe Foundry and Engineering Co., Darlington): The Gas Industry will be indebted to the Authors and the Gas Light and Coke Company for the publication of this valuable Paper on purification. The Industry must rely on the more progressive undertakings for guidance on dry purification, rather than on most other unit processes. With other plant the contractor can make a contribution—*e.g.*, he can, by the application of fundamental principles of physical chemistry, design an efficient condenser. The undertaking need only indicate the quantity of water to be employed and the allowable pressure difference, and the contractor can produce the best condenser for the duty. The same principle applies to the design of scrubbers, holders, and so on. But dry purification is a true chemical process. Moreover, it possibly depends less on the plant structural design than on intelligent operation and the correct choice of the purifying medium. The Industry must necessarily know more about this than anyone else. Accordingly, the undertaking usually specifies the materials of construction, whether mild steel, cast iron, or reinforced concrete, the degree of mechanization, and whether the boxes should be overhead or at ground level. They usually even specify the number and size of the boxes, since the volume of oxide employed is based on empirical data. All fundamental research on this process must therefore be carried out either by the larger undertakings, such as the Gas Light and Coke Company, or the oxide vendors, and this Paper is therefore a valuable supplement to the work of such people as Avery and his collaborators. It is obviously an interim report, and we shall look forward to a series of papers as the work progresses. It has obviously been rigorously curtailed in presentation, with the result that some valuable data are omitted—*e.g.*, the temperature and saturation of the gas at the inlet and outlet of the laboratory test-tubes and of the semi-technical scale boxes correlated with the corresponding oxide temperatures.

I would like to know whether the Authors considered attempting to separate the sulphiding and oxidizing reactions by the admission of air at an intermediate point, and the periodic reversal of the gas flow. It would also be interesting to hear more about the possibilities of heat conservation for the exothermic reactions. I understand that the total heat evolution is of the order of 0.5 B.Th.U., per grain of H_2S, of which the greater part is evolved during oxidation. The Authors confirm that re-oxidation is more difficult to promote than sulphiding at atmospheric temperatures; so why not make use of the oxidation to raise the temperature?

Finally, I hope the Authors will provide further interpretation of their tests for commercial application—*e.g.*, they refer to dehydration of $Fe_2S_3H_2O$ at +50°C., and +40°C.—both presumably oxide temperatures. I believe that in commercial usage pockets of oxide may easily reach 40°C. when the average gas temperature is around 85°F., this usually being regarded as the optimum value. Is such dehydration dependent, however, on the degree of saturation of the gas? The Authors also state that excellent results were obtained from *alpha* hydrate ferric oxide re-oxidized at 27°C., but as this temperature might correspond with gas at 60 to 70°F., it appears rather low to promote a satisfactory rate of oxidation, while the other temperature quoted—*i.e.*, 135°C.—is too high to be of practical significance.

The Authors' Reply

Mr. HOPTON: Perhaps a short verbal answer now might be appreciated as some of the points raised can be answered at once, although we should prefer to answer in writing some of the other points. We do appreciate the fact that a great deal of this work has to do with the fundamentals of the reaction between iron oxide and hydrogen sulphide, but we do feel that the first thing in operating iron oxide purification correctly is to know precisely what the material is and to know it reacts. Therefore we are hoping that one of the applications of the work we have described will be to examine the oxides that are commonly used, and try to see if we can distinguish those which are going to be more useful than others. That will be a development of this work. Dr. Hollings has made the position very clear, I think, with regard to the immediate application. This particular type of reagent which we have developed is of great use, either in dealing with gas with low concentrations of hydrogen sulphide or full removal of the hydrogen sulphide for very short periods of the year—*i.e.*, peak load purification.

With regard to the points that have been raised concerning the oxidation of the sulphide, I admit that we seem to have given two figures, but I do not think we have claimed to have determined very exactly at what temperature ferric sulphide hydrate becomes dehydrated. It is of the order of 50°C., and it is very doubtful whether purifiers work at quite such a high temperature. Certainly I think we have seen cases where the boxes have approached that temperature in operation. We appreciate also that the heat of oxidation is high, and in the case of the towers used in one of the large-scale tests described they were working at something like 30 to 35°C. The towers, it is true, had a rough form of lagging, but we tried to operate so that in the winter the temperature was of this order.

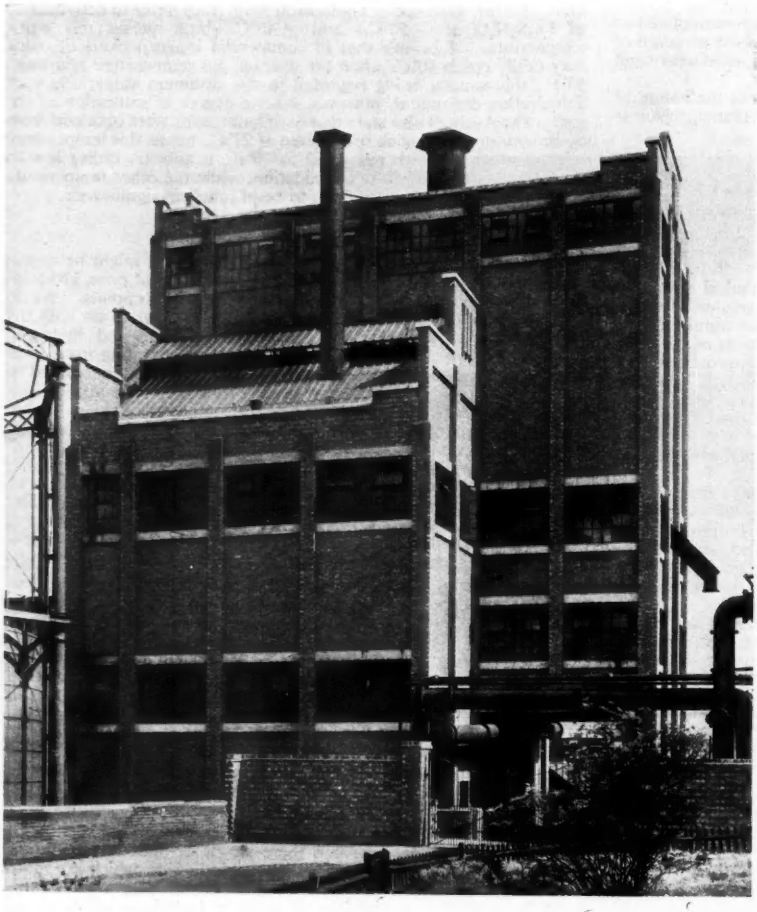
We mean to follow up the work described in this Paper with regard to the disadvantage that the pellets as at present used are spent with some 30% of sulphur. Perhaps there are other lines that might be pursued with regard to extraction. Possibly liquids, which are more commonly available on gas-works than those which have been used, could be applied to extraction by using a technique which we all know. The pellets so extracted have already been found to be just as reactive and mechanically strong as those which were freshly made.

Sales of Gas in America for the 12 months ended July 31, 1945, are given in a recent report by the American Gas Association. Total sales for this period reached 25,626,372,300 therms, an impressive gain of 5.1% over the same period in 1944. Some 2,946,853,700 therms of manufactured and mixed gas were sold, against 2,847,260,400 therms the previous year, an increase of 3.5%.

The Board of Trade has removed the restrictions on the supply and acquisition of second-hand or reconditioned office machinery, but are maintaining control on certain kinds of new machinery, namely : Adding, calculating and accounting machinery, punched card equipment, dictating equipment, addressing machinery, offset litho, hectograph spirit and rotary stencil duplicating machinery, and office printing machinery (letterpress type).

Striking Proof of the interest of overseas countries in British products is afforded by the fact (recorded in the December issue of the "Broomwade" News Bulletin) that within the last few weeks Broom & Wade, Ltd., have had the pleasure of welcoming to their works at High Wycombe visitors from Australia, Belgium, Canada, Chile, Denmark, Egypt, Federated Malay States, France, Greece, Holland, Iceland, India, Mexico, New Zealand, Nigeria, Palestine, Persia, Poland, Russia, South Africa, South America, Turkey and West Africa.

The Canadian Gas Association has published figures showing gas sales in Canada during the eight months ended August 31. Some 38,305,241,000 cu.ft. of gas were sold, an increase of 1,897,003,000 cu.ft. on the corresponding period of 1944. Sales of manufactured gas totalled 15,675,137,000 cu.ft., 482,473,000 cu.ft. more than in 1944. Of these, domestic consumers took 8,277,241,000 cu.ft., an increase of 355,462,000 cu.ft. on the comparable period. Sales of gas for industrial purposes were, however, rather less, totalling 3,589,398,000 cu.ft.



GLOVER-WEST

Vertical Retorts

at

HIGH WYCOMBE

ARCHITECTURAL FEATURES

From the layman's point of view, perhaps the most interesting feature is the attempt to produce in an essentially industrial building a pleasing architectural appearance. The steel frame-work of the building has been encased in brickwork, and the coal-receiving annexe and coke hoppers are built as integral features of the main building. A liberal use has been made of steel-framed windows for producing maximum natural lighting and ventilation. Parapets with "Snowcrete" coping form a pleasing finish to the skyline. Rain-water pipes are not visible, being taken down internally. The full effect of the building when viewed from Desborough Road is masked to some extent by the abutment of the old horizontal retort house, but when this is dismantled and the new retort house extended it will appear as an independent and symmetrically designed structure.

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Products Prices—Stocks and Shares

The London Market Jan. 7.

There are no changes to report in the prices of Coal Tar Products since our report dated Dec. 28.

Maximum prices fixed by S. R. & O. 1945, 1572, are as follows:—

Coal tar naphtha from 1s. 11d. per gall. for the 90/200 (unrectified) grade to 2s. 11d. per gall. for the 96/160. Xylole: 3s. 3½d. to 3s. 6d. per gall. according to grade. The naphtha and xylole prices are for 1,000 gall. lots delivered buyer's address in bulk. Toluole 2s. 4d. to 3s. 2½d. per gall. *ex* works in bulk in 1,000 gall. lots.

Under S. R. & O. 1943, 1528, prices for cresylic acid range from 3s. 6d. per gall. for refined acid D grade to 5s. per gall. for acid containing 52/53% metacresol. Phenol (carbolic acid crystals) 9½d. to 11½d. per lb. Creosote for timber preservation 5½d.; benzole absorbing oil 6½d. to 8d.; creosote for disinfection making 10d. to 1s. 7d. per gall.; all *ex* seller's works in bulk for minimum 800 gall. lots.

Naphthalene prices are controlled by S. R. & O. 1944, 1051.

Road tar 5½d. per gall. in buyer's tanks at seller's works. Coal tar pitch for briquette-making, 70s. per ton.

For such quantities of products as are available for export and for which licences can be obtained, higher prices can be realized.

The Provinces Jan. 7.

The average prices of gas-works products during the week were: Pitch, 70s. per ton; toluole, naked, North, 90's, 2s. 4d. to 2s. 6¾d. per gallon; pure, 3s. 2½d. Prices for carbolic acid 60's, anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.), and strained anthracene oil are controlled by S. R. & O. 1943, 1538, and for naphthalene by S. R. & O. 1944, 1051. Prices for road tar were increased by a half-penny per gallon by S. R. & O. 1945, 229, under which Order there was also an increase of 5s. per ton in the price for standard creosote-pitch mixture.

The bulk of the pitch produced in this country is required for home trade purposes, but certain quantities are being sent at higher prices to Allied countries with the approval of the Coal Tar Control. So far as creosote is concerned the bulk is required for essential purposes, at controlled prices. With regard to hydrocarbon oils, the prices remain fixed, although there is more freedom than was previously the case.

Scotland Jan. 5.

Inquiries are numerous, with prices firm. Refined tar*: Yield to distillers is 5d. per gallon *ex* Works, naked. Creosote oil: Timber preserving quality,* 5½d. to 6½d.; hydrogenation oil,* 5⅞d.; low gravity or virgin oil,† 7¼d. to 7½d.; benzole absorbing oil,* 6½d. to 8d. per gallon. Refined cresylic acid* is 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha†: 7d. to 8d. per gallon. Solvent naphtha*: Basic maximum prices delivered in bulk, 90/160 grade, 2s. 10d., and 90/190 Heavy naphtha, Unrectified, 2s. 0½d.; Rectified, 2s. 4d. per gallon. Pyridine†: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

* Price controlled. Naphtha prices were, hitherto, fixed. † Uncontrolled.

The New Year opened in the stock markets with a cheerful sentiment. Considerable activity took place in gilt-edged stocks, while speculative interest was largely confined to the Kaffir market. Heavy profit-taking sales in the latter at the close led to a reaction in prices.

There was a fair volume of business among gas stocks and shares, but it will be seen below that a number of issues weakened again. The heaviest fall was that of Sheffield consolidated, which, changing hands at 130$\frac{3}{16}$, closed 13 points lower at 130; Bristol also weakened.

The following were the price changes during the week:

PROVINCIAL EXCHANGES

Bristol 5 p.c. max.	114—116	−2½
Hartlepool Cons.	92½—94½	+1½
Newcastle 3½ p.c. Deb. (*x.d.*) ...	98½—99½	Dec. 27
Ditto 3½ p.c. Red. Deb. (*x.d.*) ...	98½—100½	"
Sheffield Cons....	125—135	−13
Sunderland Ord.	124½—126½	+½

OFFICIAL LIST

Associated Gas & Water Ord. ...	19/—21/-	—/6d.
Ditto 4 p.c. Red. Cum. Pref. ...	19/- 21/-	—/6d.
Bournemouth max. div.	153—158	−2
Croydon 5 p.c. Deb. (*x.d.*)	113—118	Dec. 31
East Surrey 5 p.c. Deb. (*x.d.*) ...	113—118	Dec. 27
Gas Consolidation Ord. "B" ...	19/—21/-	−1/-
Gas Light 4 p.c. Pref....	99—102	−1
Ditto 3¾ p.c. Red. Pref. (*x.d.*) ...	99—102	Dec. 31
Ditto 5 p.c. Red. Deb.	104—108	−1½
Imperial Continental Ord.	105—110	−1
Liverpool Ord.	111—116	−1
Primitiva Holdings Ord.	12/3—13/3	—/6d.
Severn Valley Gas Corporation Ord.	20/—22/-	—/6d.
South Metropolitan Ord.	88½—91½	+½
Ditto 3 p.c. Deb. (*x.d.*)	88—91	Dec. 31
South Suburban 5 p.c. Deb. ...	114—119	−1
Tottenham 5 p.c. Pref.	108—113	−2

SUPPLEMENTARY LIST

Croydon 4 p.c. Deb. (*x.d.*)	98—103	Dec. 31
Malta and Mediterranean 7 p.c. 1st Pref.	95—105	+5
Ditto 7½ p.c. 2nd Pref.	95—105	+5
Tottenham 5 p.c. Reg. Red. Mortgs. (*x.d.*)	98—101	Jan. 2

TRADE CARDS

FULL particulars of these spaces can be obtained on application to the Publishers. They are designed principally for the use of the firms whose display advertisements cannot be included owing to paper rationing.

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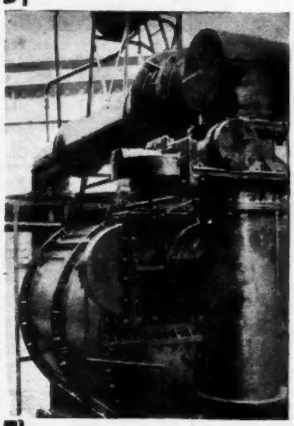

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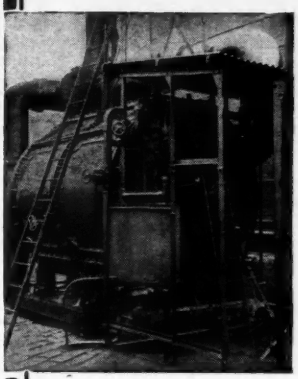

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